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# RADIO NEWS

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Over 200 Illustrations

Edited by HUGO GERNSBACK

RADIO'S GREATEST MAGAZINE

EXPERIMENTER PUBLISHING COMPANY, NEW YORK, PUBLISHERS OF

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# RADIO NEWS

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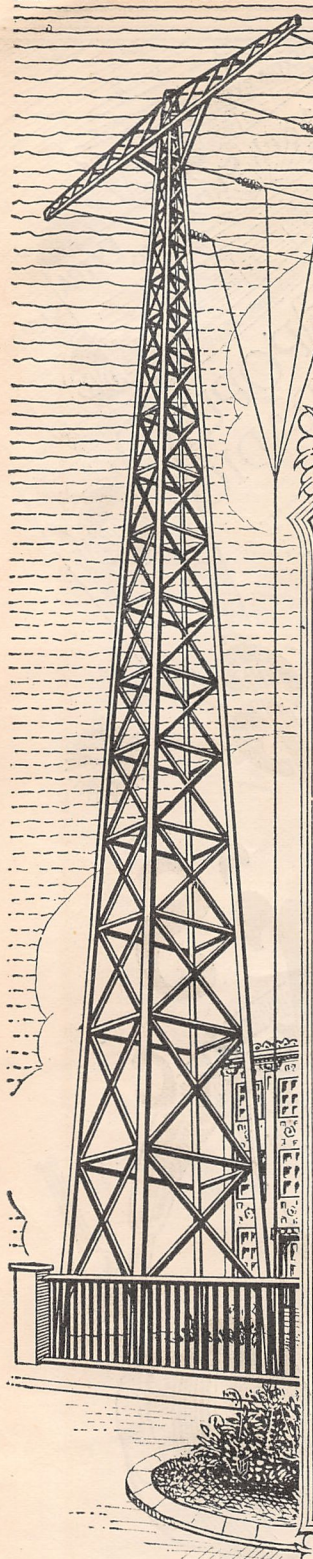


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**By Lt.-Col. Chetwood Crawley, M.I.E.F.**

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* * *

**The Radio "Uni-Set"**
**By H. M. Towne, 1ADG**

An article covering the construction of a practical combination transmitting and receiving set of high efficiency.

* * *

**The Role the Atmosphere Plays in the Propagation of Radio Waves.**
**By Prof. Joseph Guinchant, of the Faculty of Science, Bordeaux, France.**

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* * *

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* * *

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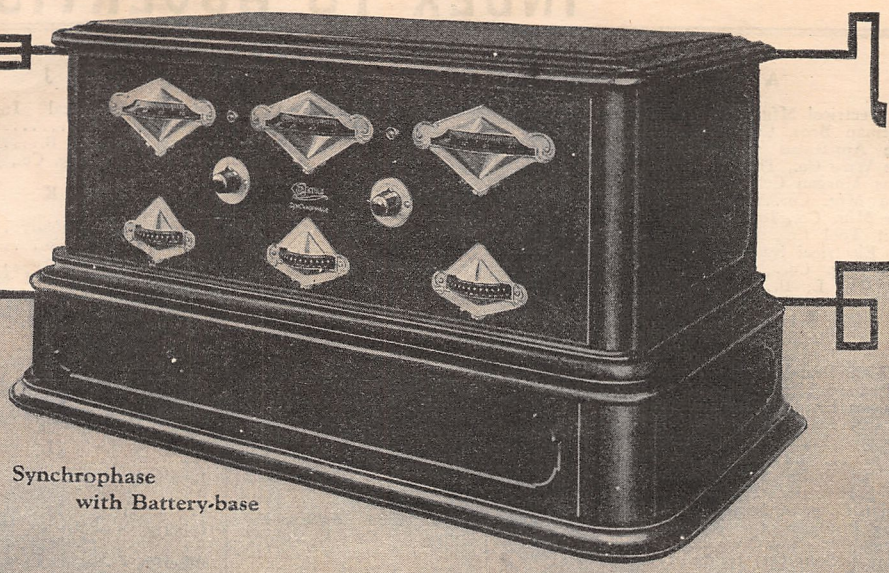

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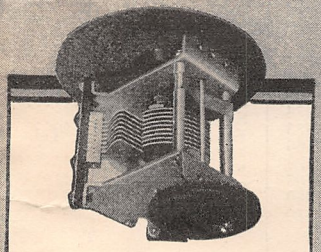

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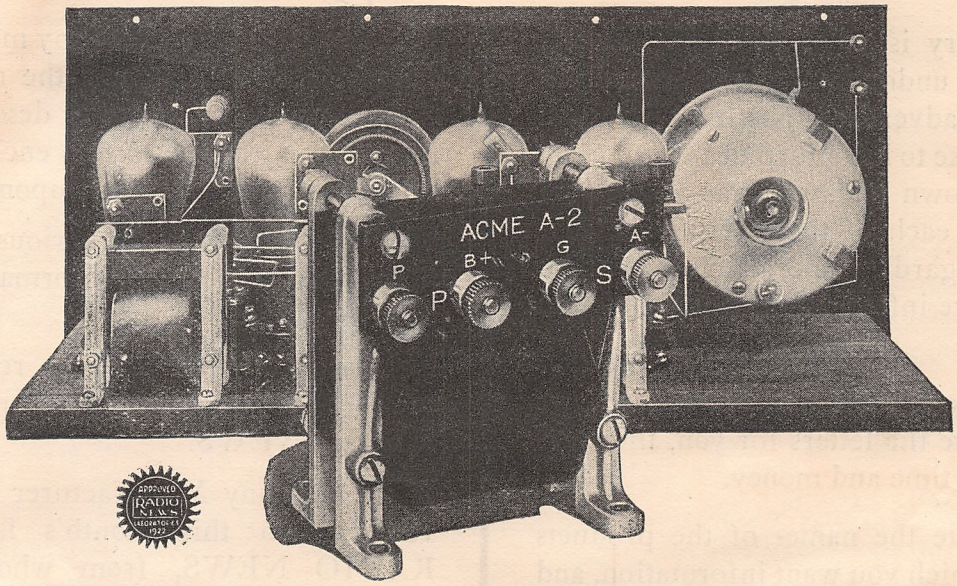
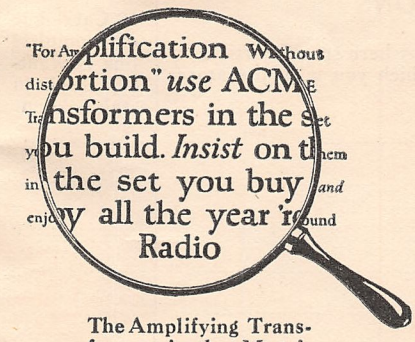
# *You can give your set this big advantage—*




## Amplification without Distortion

*How to make sure of getting everything l o u d and clear*

YOU can make your set so that it will reproduce clearly and distinctly without distortion. The real pleasure in radio comes when you can understand and enjoy what you hear—voices that are natural—music that is clear in tone. In order to hear clearly and distinctly you want to be sure that you are using amplifying transformers that amplify the sound without distorting it.




The Amplifying Transformer is the Magnifying Glass of Radio

Give your set this big advantage—Amplification without Distortion. Whether you have a neutrodyne, super-hetrodyne, regenerative or reflex the addition of the Acme A-2 Audio Amplifying Transformer will make it better.

The Acme A-2 has become famous among radio owners for increasing the volume of sound without distorting. It has improved thousands of radio sets. If you are bothered by distortion, try an Acme A-2 and note the difference.

Each transformer is tested and carries a guarantee tag. If you want Amplification without Distortion use Acme Transformers in the set you build and insist on them in the set you buy. (That's one of the big reasons why the Acmeflex Kit-set gives such good results—it uses Acme Transformers.) Send for our 40-page booklet which explains how to get the best results by proper amplification and also contains a number of valuable wiring diagrams. It will help you build a set. Mail the coupon with 10 cents.

ACME APPARATUS COMPANY
Transformer and Radio Engineers and Manufacturers
Dept. 73, Cambridge, Mass.

## *Have the fun of making your own radio set*

# ACME

## *~ for amplification*

ACME APPARATUS COMPANY
Dept. 73, Cambridge, Mass.

Gentlemen:—
I am enclosing 10 cents (U. S. stamps or coin) for a copy of your book "Amplification without Distortion."

*Name* .....

*Street* .....

*City* ..... *State* .....

# RADIO NEWS READERS' BUREAU

## *Time and Postage Saver*

IN every issue of RADIO NEWS you undoubtedly see numerous articles advertised about which you would like to have further information. To sit down and write an individual letter to each of these respective concerns, regarding the article on which you desire information, would be quite a task.

As a special service to our readers, we will write the letters for you, thus saving your time and money.

Just write the names of the products about which you want information, and to avoid error the addresses of the manufacturers, on the coupon below and mail it to us.

If the advertiser requires any money or stamps to be sent to pay the mailing charges on his catalogue or descriptive literature, please be sure to enclose the correct amount with the coupon.

We will transmit to the various advertisers your request for information on their products.

This service will appear regularly every month on this same page in RADIO NEWS.

If there is any Manufacturer not advertising in this month's issue of RADIO NEWS, from whom you would like to receive literature, write his name, address and the product in the special section of the coupon below.

TEAR ALONG THIS LINE

RN-2-25

**READERS' SERVICE BUREAU,**
**Experimenter Publishing Co., Inc., 53 Park Place, New York, N. Y.**

Please advise the firms listed below that I would like to receive detailed information on their product as advertised in the ..... issue of RADIO NEWS.

☞ DO NOT USE THIS COUPON FOR TECHNICAL QUESTIONS

| NAME | ADDRESS (Street — City — State) | List here specific article on which you wish literature. | If Catalogue of complete line is wanted, check in this column |
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Use this space if you desire information from a manufacturer whose advertisement does not appear in this month's issue.

| NAME | ADDRESS (Street — City — State) | |
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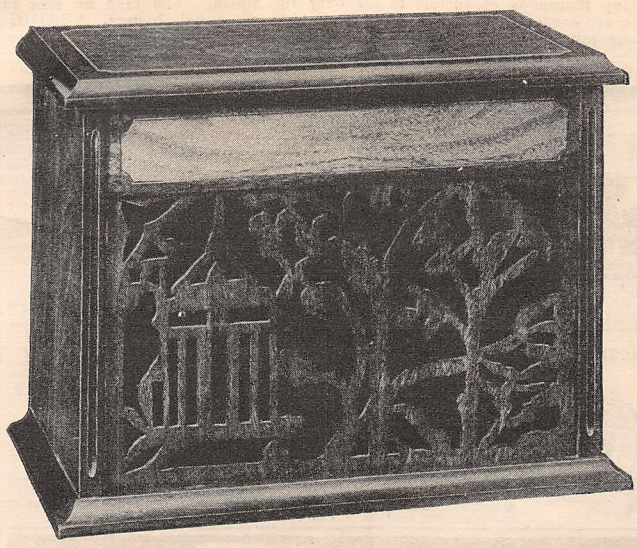
Your own name here .....

☐ If you are dealer check here.

Address .....

City ..... State .....



# Twenty-five years of musical experience built into a radio speaker

*The Royal Radio Speaker Modulator*

THE tone modulator makes accurate shading of tone possible without distortion or magnifying interfering noises. The modulator is readily accessible merely by lifting the lid.

IN beautiful cabinet design and finish as well as in musical accoustic properties, Royal Radio Speaker combines the experience of a quarter of a century in manufacturing high grade pianos, organs, and phonographs.

With the Royal Radio Speaker you always have the best seat in the house. You never seem so near that there is discord nor so far that the delicate overtones of a symphony orchestra or the obligato of a harp is lost.

Royal Radio Speaker reinterprets music and a speaker's words with a fidelity that is wonderfully realistic. It seems as if you were in the presence of the performer.

The Tone Modulator of Royal Radio Speaker has overcome the chief problem of radio amplification, that of preserving all the naturalness of tone of head phones without the distortion or emphasis of interfering noises that is associated with ordinary loud speakers.

The necessity for maximum amplification to bring in distant stations has heretofore presented what seemed to engineers to be an insurmountable difficulty. Royal Radio Speaker has solved it well by the combination of a Scientifically Synchronized Tone Chamber coupled with the Tone Control Modulator.

So unobstrusive is the Royal Radio Speaker that whether operated directly on the radio set or at some point distant, it is never conspicuous. The cabinet work is all that a lover of beautiful furniture can desire. In two finishes either duo-tone walnut or mahogany, it will add charm to any setting in which it is placed.

Royal Radio Speaker will operate with any radio set where amplification is possible. It is particularly effective with Adler-Royal Neutrodyne and in cabinet design harmonizes perfectly with Adler-Royal instruments.
Royal Radio Speakers are on sale at high class dealers everywhere. If your dealer does not carry it, please address us.

## *Price $30.00*

ADLER MANUFACTURING COMPANY, INC.
*General Sales Office*: Dept. RN2, 881 Broadway, New York City
*Factories*: Louisville, Ky.

# Royal Radio Speaker

ADLER MANUFACTURING CO. RN 2
881 Broadway, New York City.

Gentlemen:
I want to know more about the three special features of Royal Radio Speaker. Please send me your literature and at the same time mail me the complete catalogue of the Royal Line of Radio Sets, Phonographs and Combinations.

*My name is* .....

*Street* .....

*City* ..... *State* .....

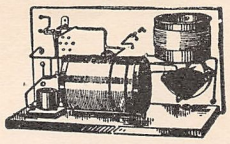
BARAWIK

# 60,000 Barawik Sets Prove Our Reliability

VALUE

We have many thousands of customers all over the world. You take no risk in dealing with us. We are one of the oldest and most reliable radio supply houses. "RADIO NEWS" guarantees our reliability. Let us serve you and save money for you. All orders shipped same day received.

## COCKADAY CIRCUIT

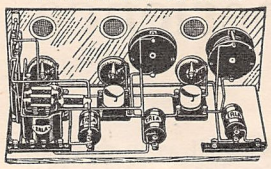


**M873** Complete parts, 1 tube set..$10.25
**M874** Complete parts, 3 tube set.. 18.75
A very selective set that will tune out even nearby stations. A favorite circuit with many builders. One tube set has 7x14 panel, 3 tube 7x21. Panels are drilled for easy assembly. Instructions furnished for assembly.

## IMPROVED COCKADAY CIRCUIT

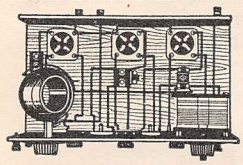
**M875** Complete parts for 5 tube set $48.65
This is the latest model Cockaday circuit with resistance coupled amplifier. Green silk coil wound on bakelite tubing, highest grade grounded rotor low loss condensers and best grade parts throughout. 7x24 panel drilled ready to mount parts. Complete with instructions for assembling.

## ERLA REFLEX CIRCUITS



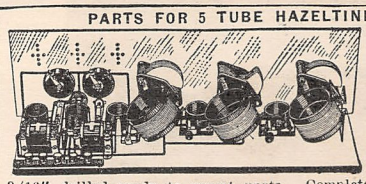
**M876** Complete parts, 1 tube set..$21.50
**M877** Complete parts, 2 tube set.. 31.95
**M878** Complete parts, 3 tube set.. 38.90
These circuits have opened a new field in radio. One tube does the work of three in an ordinary set, two equal four, three equal five. Crystal detector improves quality of reproduction, preserving the full mellow tones of the original. Easily handled, will bring in distance well. All parts are genuine Erla exactly as specified in Erla circuits. Panels are drilled for easy assembly. One tube set has 6x7 panel, two tube 7x14, three tube 7x18.

## AMBASSADOR CIRCUIT



**M881** Complete parts for 3 tube set $20.95
A three circuit set that is very selective and sensitive and brings in distant stations with excellent volume. Genuine Ambassador tuning coil wound throughout with Litz wire permits sharp tuning. Simple to build and operate. Genuine bakelite panel, size 7x18, drilled ready to mount parts. Complete with instructions for assembling.

## PARTS FOR 5 TUBE HAZELTINE NEUTRODYNE CIRCUIT



**M858** Complete set parts, including mahogany finished cabinet .....$33.50
All the parts needed to build this circuit which is the leader of all circuits today. Tunes thru interference. Easy to find stations once they have been located. Brings in distant stations on the loud speaker in clear pure tones with wonderful volume. Essential parts licensed under Hazeltine patents. Genuine bakelite panel 7x24x 3/16" drilled ready to mount parts. Complete instructions furnished for assembling and wiring. With these parts you can easily build a high grade set at low cost. Note that all our prices are prepaid.

## LICENSED NEUTRODYNE PARTS

**M852** Licensed Neutrodyne Kit .....$14.95
Includes three licensed Neutroformers, 2 neutrodons, panel layout, template and book of instructions for building up neutrodyne set. By adding other parts a neutrodyne set can be built at low cost.

## TUNED RADIO FREQUENCY UNIT

**M853** Each .....$2.75
Three for ..... 7.85
Consists of radio frequency transformer wound on bakelite tubing and high grade variable condenser. For use in tuned radio frequency circuits. Usually used in sets of three. Condenser shaft ¼" diam.

## BALANCING CONDENSERS

**M854** Pair .....70c
Sold in pairs for neutralizing the capacity in two-stage radio frequency circuits.

$42.50

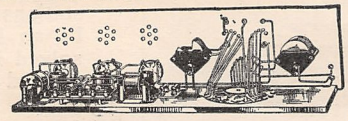
# 5 Tube Bargain

The greatest radio value ever offered

**A five-tube radio frequency set that brings in the distant stations on the loud speaker. All the volume you could want with the finest tone quality, clear and sweet. Careful designing with big quantity production make our low price possible. Only the finest quality materials used throughout. New style efficient low loss condensers and transformers. Bakelite panel size 7x18 in. Handsome mahogany finish cabinet. Neat convenient dials. We can recommend this set for either city or country use. Will not reradiate and will bring in stations from coast to coast. No set approaches this for value. Equals many sets selling at double and triple our price. Try it for ten days. If you are not satisfied return it and we will refund your money.**

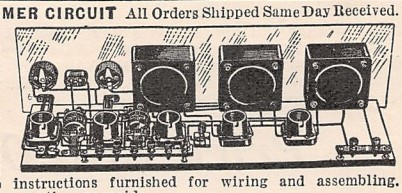
**M867 Set, only .....$42.50**
**M868 Set complete with five 201A tubes, 90 volts B battery, 100 ampere storage battery, one M613 Special Speaker, and complete antenna equipment Nothing extra to buy. Price .....$82.00**

## PARTS FOR REINARTZ CIRCUIT



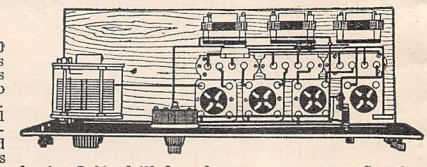
**M862** Complete set of parts for one tube set .....$10.75
**M863** Complete set of parts for three tube set .....$17.95
One of the best circuits for bringing in distant stations. Can be built at very low cost yet produces fine results. Easy to handle. The three tube provides loud speaker volume on distant stations. One tube set has 7x14 panel, 3 tube set 7x21 panel. Panels are drilled for easy assembly. Complete with instructions for assembling.

## PARTS FOR 5 TUBE PHUSIFORMER CIRCUIT All Orders Shipped Same Day Received.



**M880** Complete set of parts, including high grade cabinet..$35.95
One of the easiest sets to build. Best results assured. Two stages tuned radio frequency amplification detector and two stages audio amplification. Brings in the distant stations with great volume and purest tones. Best grade parts furnished throughout. Genuine bakelite panel 7x26x3/16" drilled ready to mount parts. Complete instructions furnished for wiring and assembling. Note that all our prices are transportation prepaid.

## ACME REFLEX CIRCUIT



**M883** Complete parts for 4 tube set .....$44.50
One of the most efficient circuits known. Combines three stages of radio frequency and audio frequency using only four tubes. Crystal detector gives unusual clarity. Genuine Acme condenser. Pot Rheo, radio and audio frequency transformers supplied. Genuine bakelite panel, size 7x21, drilled ready to mount parts. Complete with instructions for assembling.

## SPIDER WEB COIL FOR REINARTZ CIRCUIT

**M296** Each .....$1.05
A very unusual value. Made of green silk covered wire, spiderweb wound. 21 taps so arranged that crossing avoided. Mounting bracket permits various styles of mounting. Directions included.

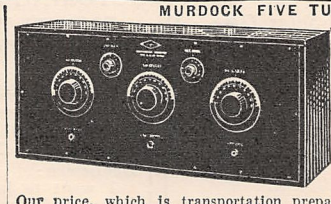
## COCKADAY PARTS

**M298** Per set....$1.65
Complete set coils for Cockaday circuit. Properly calculated and made to give best results in this new wonder circuit.
**M276** Amplex grid-denser for Cockaday Improved 5 tube circuit.....$1.10

## LARGE CAPACITY FIXED CONDENSERS

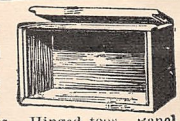
Tested for use in the new radio circuits. Metal cases. Soldering lugs for connections. Best materials. Carefully made.
**M358** .25 mfd...55c **M359** .5 mfd...$.65
**M360** 1. mfd...85c **M361** 2. mfd...1.35

## MURDOCK FIVE TUBE NEUTRODYNE SET



**M870** Complete with tubes, batteries and accessories as listed below.....$159.50
A high grade, genuine five tube Neutrodyne set at an unusually attractive price. Manufactured under the Hazeltine patents. Engraved panel and finely finished solid mahogany cabinet lend richness and dignity to its appearance. Easy to tune. When station has been heard once and record made of dial setting you need only set dials at same point and if station is broadcasting it will be heard. Brings in distant stations loud and clear on loud speaker. Our price, which is transportation prepaid, includes the following: Set in cabinet, five C501A or UV201A tubes, 100 ampere hour storage "A" battery, two 45 volt "B" batteries, one Magnavox M4 loud speaker and complete antenna equipment consisting of wire, insulators, lightning arresters, etc.

## CABINETS



Fine looking cabinets solidly built. Elegant hand rubbed dark mahogany finish. You will be proud of your set mounted in one of these cabinets. Hinged tops. Panel fits flush in front recess. Panels not included. Inside depth 7 inches except 9x14 12x14, 12x21, which are 10 in. deep. Prices quoted are prepaid and are the lowest ever offered on quality cabinets.

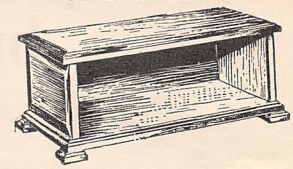
| Panel Size | Art. No. | Price Each | Panel Size | Art. No. | Price Each |
|---|---|---|---|---|---|
| 6x7" | M420 | $1.95 | 7x21" | M425 | $3.20 |
| 6x10½' | M422 | 2.45 | 7x24" | M429 | 3.40 |
| 7x10" | M421 | 2.60 | 7x26" | M431 | 3.50 |
| 7x12" | M424 | 2.85 | 9x14" | M428 | 3.55 |
| 7x14" | M423 | 2.95 | 12x14" | M430 | 4.00 |
| 7x18" | M426 | 3.05 | 12x21" | M432 | 5.05 |

## BASE BOARDS FOR CABINETS

Fasten to bottom of panel and fit inside cabinets. ⅜ inch thick, 6½ inches wide

| Art. No. | Length Inches | Price Each | Art. No. | Length Inches | Price Each |
|---|---|---|---|---|---|
| M435 | 6½ | 19c | M439 | 17½ | 29c |
| M436 | 9½ | 23c | M440 | 20½ | 31c |
| | | | M441 | 23½ | 33c |
| M437 | 11½ | 25c | M442 | 25½ | 39c |
| M438 | 13½ | 27c | | | |

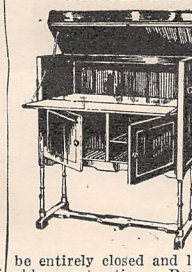
## DE LUXE CABINET



The finest quality cabinet. A piece of furniture worthy of the best set. Made of genuine solid walnut in elegant hand rubbed natural walnut or brown mahogany finish. State which is wanted. Top has piano hinge and lid support. Feet at base add to striking appearance. Inside depth 9 inches.

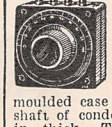
| Panel Size | Art. No. | Price Each | Panel Size | Art. No. | Price Each |
|---|---|---|---|---|---|
| 7x18 | M444 | $7.65 | 7x26 | M447 | $10.50 |
| 7x21 | M445 | 8.25 | 7x28 | M449 | 11.50 |
| 7x24 | M446 | 8.95 | 7x36 | M448 | 13.75 |

## CONSOLE RADIO CABINET



**M902** Prepaid price, each $37.50
A high grade piece of furniture. Neat appearance. Elegant finish. Looks well among finest furnishings. Top compartment takes any set or panel size 9 in. high, 10 in. deep, 33 in. long or smaller. Lower compartments hold batteries, chargers and all accessories. Can be entirely closed and locked. Strong durable construction. Paneled doors. Fine mahogany or walnut finish. Size over all, 37 in. wide, 14 in. deep, 42 in. high.

## PHUSIFORMER



**M546** Each .....$6.85
A new device especially designed for tuned radio frequency circuits. Consists of primary and secondary inductively coupled coils connected with variable condenser, all enclosed in moulded case with binding posts. Dial on shaft of condenser. Size 4½ in. square, 2 in. thick. Three units occupy small space and can be used to make up a very efficient 5 tube set at low cost.

## COILS FOR HARKNESS CIRCUIT

**M295** Per set of two $1.95
Green silk windings on genuine bakelite tubes. Properly calculated to give best results.
**M879** Complete parts for 2 Tube Harkness Reflex Set with panel drilled for mounting parts and instructions for assembling $15.85

The Barawik Co.
102 So. Canal St. Chicago, Ill.

BARAWIK

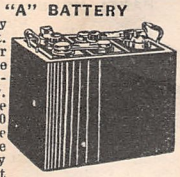
# Prices Now are Lower than Ever Before

WE PAY TRANSPORTATION CHARGES IN U. S. EAST OF THE ROCKIES
THE PRICES QUOTED DELIVER THE GOODS TO YOUR DOOR
ALL ORDERS SHIPPED SAME DAY RECEIVED

**THIS GUARANTEE PROTECTS YOU**—Examine the goods we ship you. They must suit you in every respect. If you are not satisfied with your purchase return the goods at once and we will refund the price you paid

QUALITY

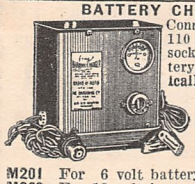
### STORAGE "A" BATTERY



The best battery buy on the market. Guaranteed for three years. Made of best new materials. Full capacity. Try one of these batteries for 10 days. If at the end of that time you are not fully satisfied return it and we will refund the purchase price. Note our prices are prepaid. Transportation cost considered these are the lowest prices obtainable. We deliver this high quality battery to you for less than the cost of inferior batteries.

M194 6 volt, 60 amp. size. Each..$9.90
M196 6 volt, 100 amp. size. Each..13.25

### BATTERY CHARGER



Connect charger to 110 volt 60 cycle light socket and your battery charges automatically over night at a cost of only a few cents. Cord and clips for connections included.

M201 For 6 volt battery.....$12.95
M203 For 12 volt battery..... 12.95

**Noiseless Rectifier Bulb Charger**—King, Tungar or Rectigon.
M255 2 amp..$15.95 M256 5 amp..$24.95
Extra Bulbs.
M257 2 amp...$3.80 M258 5 amp...$7.60

### HYDROMETER

M190 Each .....48c
Helps keep battery in better shape by showing exact condition.

### BATTERY CLIPS

M198 Two for .....28c
Clip onto storage battery terminals, lead coated. Make positive non-corrosive contact at all times.

### "A" BATTERY CORDS

M191 Per pair .....69c
Two heavy insulated stranded copper wires 5 feet long. Battery clip on one end and binding post terminal on other end. Eliminate shorting of "A" battery. Provide positive connections.

### CONNECTING CORD SET

M192 Each .....52c
Five connecting cords with braid over all. Each cord has distinctive colored covering. Terminals for connections. Makes connecting of both A and B batteries to set easy with no mistakes in polarity or voltage. Will reach from table to floor or for use in any type cabinet. Does away with unsightly wires. This is a $1.00 retail value.

### PLATE CIRCUIT "B" BATTERIES

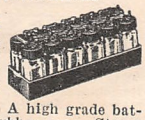
Reduced prices. A leading standard brand advertised to sell at much higher prices. No better battery made. Longest service.
M180 Small size 2 by 2¼ by 3⅜ Inches 22½ volts. Each ....95c
Ten for .....$8.60
M184 Large size, 5 taps. Size 3x4x6½", 22½ volts. Each..$1.65 Ten for..$14.70
M188 Large size, 6 taps. Size 3x8x6½", 45 volts. Each...$2.90 Ten for..$27.90

M181 22½ volt. New upright size 3x2½x5½ in. Takes less space in set. Each.....$1.50
M183 45 volt upright size 3x7x 8 in. Each $2.90. Ten for $27.90

### "C" BATTERY

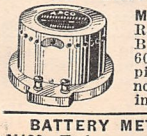
M186 4½ volt C battery size 4x 1⅝x3". Ea.42c Ten for ...$3.95

### STORAGE "B" BATTERIES



M202 12 cells, 24 volts. Each .....$3.95
More economical than dry cell "B" batteries on sets using 3 or more tubes. Can be recharged when run down. Capacity 2500 milliamperes. A high grade battery. Glass jars with rubber caps. Strong moulded tray. Shipped dry so as to be mailable. No Electrolyte included.

### "B" BATTERY CHARGER



M205 Each .....$8.95
Recharges 2 or 4 volt B batteries from 110 volt 60 cycle light socket rapidly and at practically no cost. Keeps batteries in good condition.

### BATTERY METERS

M189 Each .....82c
Reads 0 to 50 volts. Accurately tells you condition of "B" Battery. Convenient watch size. Tests 22½ and 45 volt batteries.
M193 Combination meter .....$1.30
Reads 0-50 volts; 0 to 35 amperes. Tests "B" and "A" dry cells.

### PHONOGRAPH ADAPTERS

M771 Fits single unit to tone arm. Each .....39c
M773 Fits any double headset to tone arm. Each...65c
Convert your phonograph into a loud speaker. Take off the reproducer and replace with adapter and unit or headset. Such a combination will equal or surpass in tone and volume many high priced speakers.

### SUPERIOR RADIO PLUGS

Both styles take two sets of cord tips. Polished round barrels.
M397 With turned fibre barrel. Highest grade obtainable. Each.....44c
M395 With black moulded composition barrel. Wonderful value. Each.....25c

### NEW STYLE PLUG

M401 Each .....59c
Cords are held firmly in place but can be detached instantly without taking plug apart. No screws to loosen. Bakelite body. Fits all standard jacks. Best plug made.

### LOUD SPEAKER UNITS WITH PHONOGRAPH ATTACHMENTS

Make a loud speaker of your phonograph. These attachments consist of a high grade speaker unit arranged to attach to tone arm of phonograph in place of a reproducer. Fit Victor, Sonora, Silvertone and other phonographs having same size tone arm.
M602 Baldwin .....$7.45
M607 Western Electric ..... 8.55

### EXTENSION CORDS

M403 30 ft. .....$1.95
Place loud speaker wherever desired without moving set. Consists of high grade receiver cord of length specified with plug on one end and jack on other to take plug on loud speaker cord.

### PHONE CUSHIONS

M774 Pair .....43c
Made of soft sponge rubber. Light as a feather. Fit any phones. Exclude all noises and make wearing phones a pleasure.

M613 Special Sale Price.....$5.95
This speaker is a marvel for volume and quality of tone. It is actually superior to most of the higher priced speakers and at our price is the biggest value on the market. Guaranteed to please you. Beautiful mottled black finished fiber horn. Bell diameter 10 inches. Height 21 inches. Complete with cord.

### BARAWIK QUALITY HEADSET




M770 Spec. Price per Set..$2.28
These headsets are the very best for tone quality and volume. Finest quality. Designed to sell for much higher prices than we ask and at our price are a wonderful bargain. Receiver cases are fine polished black finish. Comfortable fabric covered head band. Complete with 5 foot cord.

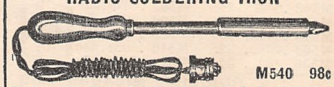
### CABINET TYPE LOUD SPEAKER

M605 Prepaid price, each .....$12.50
A fine loud-speaker with a full rich tone and unusual volume. Amplifying chamber and unit enclosed in fine mahogany finished cabinet with silk backed grille front. Very convenient and better looking than most other types of speakers. A wonderful value at our price, in our opinion equal to other speakers sold at double our price.

### STANDARD BRAND LOUD SPEAKERS AND UNITS

M618 Brandes Table Talker.....$7.95
M616 Atlas Loudspeaker .....21.95
M620 Baldwin Loud Speaker.....22.50
M603 Magnavox M4 Loudspeaker...21.00
M612 Magnavox R3 Loudspeaker...29.50
M614 Magnavox M1 Loudspeaker...26.50
M757 Morrison Adjustable Unit.... 4.45
M755 Genuine Baldwin Type C unit 4.75
M608 Atlas Unit. Each.....10.75

### RADIO SOLDERING IRON



M540 98c
This guaranteed iron is exactly right for radio work. A neat solid connection quickly and easily made. Operates on any lighting current 100 to 120 volts. 6 ft. cord with attaching plug. Length 13 inches.

### HEXAGON NUT WRENCHES

M950 Set of 3...60c
Handiest tool made for tightening hexagon nuts. Fit nuts for 4/36, 6/32, and 8/32 screws, the three most popular radio sizes.

### STANDARD BRAND HEADSETS

M754 Baldwin Type C.....$8.95
M764 Frost, 2000 ohm..... 3.30
M766 Frost, 3000 ohm..... 3.95
M751 Murdock 56, 2000 ohm..... 3.25
M752 Murdock 56, 3000 ohm..... 3.90
M768 Brandes Superior, 2000 ohm.. 4.85
M769 Brandes Navy, 3000 ohm..... 6.85

### MULTIPLE PLUG

M402 Each .....89c
Attach any number of headsets up to four. Cords attached or detached instantly without taking plug apart.

### LONG BLADE SCREWDRIVERS

M947 6 inch ....20c
M948 8 inch ....25c
M949 10 inch .....30c
Long narrow blade makes it easier to get in difficult places. Wood handle. Length given is over all.

### LONG NOSE PLIERS

M970 Each .....83c
The handiest pliers for radio work. Made of fine hardened steel. Length 5".

### DIAGONAL JAW NIPPERS

M972 Each .....75c
For fine electrical work, made of hardened steel. Cuts wire clean in tight places. Length 5 inches.

### TINOL

M969 Per tube ..19c
A combined solder and flux in handy form. Put a little on the connection, heat with a match, torch or solder iron and you have a neat electrically and mechanically perfect joint.

### ROSIN CORE SOLDER

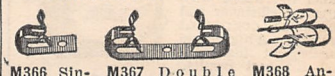
M973 4 ounces .....23c

## All Orders Shipped Same Day Received

### LIGHT SOCKET ANTENNA

M978 Each .....97c
Screws into any light socket. Replaces the regular out door antenna. Very satisfactory for nearby stations and under favorable conditions will bring in distant stations. Easy to install. No danger. Gives clear reception with little static interference. Ideal for people in apartment buildings.

### FAHNESTOCK CONNECTORS



M366 Single Connector. Dozen 16c
M367 Double Connector. Dozen 38c
M368 Antenna Connector. Each ...8c

### ANTENNA MAST FITTINGS

M952 For ½ inch pipe. Per set .....$1.00
M953 For 1 inch pipe. Per set .....$2.95
Set includes adjustable base to fit roof peak or flat surface, center guy wire fastening ring and top cap with pulley for rope to raise and lower antenna. No pipe included. Makes the installation of a first class antenna simple and inexpensive.

### ANTENNA OUTFIT

M272 Each .....$2.70
Consists of 150 feet stranded copper antenna cable, lightning arrester, four wall insulators, two antenna insulators, antenna lead-in, 25 feet insulated ground wire, ground clamp and 25 feet connecting wire.

### STRANDED ANTENNA WIRE

Cabled of fine copper strands. Very flexible. High tensile strength. Best for aerials.
M248 100 ft. coil 48c M249 500 ft. coil $2.30

### SOLID BARE COPPER WIRE

Solid bare copper wire for aerials, leads or wiring instruments. Size 14.
M240 100 ft. coil 42c M242 500 ft. coil $2.05

### GROUND CLAMP

M273 Made of soft copper ⅝" wide with Fahnestock connector. Fits any pipe ¾ to 1 inch wide. Each .....8c

### ANTENNA INSULATORS

M263 Ribbed Porcelain insulator, 2½ in. long. Ea. 6c
Dozen .....55c
M265 Ribbed Porcelain insulator—5 inches long. Each 15c

J263

### ANTENNA LEAD-IN

M259 .....15c
Antenna wire is brought in without drilling a hole Place on window sill and window can be closed down tight and locked as before. Well insulated. Can be bent into any shape. Made of copper strip properly insulated.

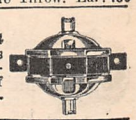
### WALL MOUNTING INSULATOR

M262 Each..7c
Dozen .....65c
Galvanized screw mounting
Lead-in wire passes through center of porcelain insulator and is kept away from possible grounds. Easily installed.

### PORCELAIN BASE SWITCHES

Fine white porcelain bases. Copper contacts and blades. Can be used as antenna switches.
M385 Single Pole Single Throw. Ea...18c
M383 Single Pole Double Throw. Ea..25c
M384 Double Pole Double Throw. Ea..45c

### OUTDOOR ARRESTER

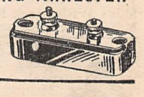


M980 .....$1.24
Protect your instruments with this lightning arrester. Weatherproof Bakelite case. Underwriters approved.

### JEWELL LIGHTNING ARRESTER

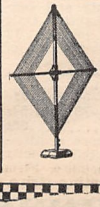
M981 Each .....68c
A dependable protector, always on guard. Small and compact. Weatherproof porcelain case. Easily fastened and connected. Underwriters approved

### SUPERIOR LIGHTNING ARRESTER



M982 Each .....39c
Porcelain block with brass binding posts. Dependable and effective.

### COLLAPSIBLE LOOP ANTENNA



M976 Each .....$3.80
A full size loop antenna 31 in. high 28 in. wide. Folds into compact case 18 in. long, 3 in. diam. Well made. Fine looking. Insulated wire, extra flexible. Suitable for use with any loop set. Case included. Quickly set up or taken down.

The Barawik Co.
102 So. Canal St. Chicago, Ill.

BARAWIK

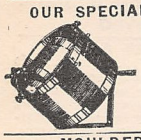
# It is Easy to Build Your Own Radio Set

QUALITY

WE PAY TRANSPORTATION CHARGES IN U. S. EAST OF THE ROCKIES
THE PRICES QUOTED DELIVER THE GOODS TO YOUR DOOR
ALL ORDERS SHIPPED SAME DAY RECEIVED

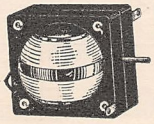
**HOW TO ORDER**—Write your Order plainly, state Article Number, Description and Price of items wanted. Send Postoffice or Express Money Order, Certified Check or Bank Draft for Total of Order. Prompt Shipment is assured when these directions are followed.

### OUR SPECIAL VARIOCOUPLER



M418 Each .....$1.80
The most efficient type of coupler. Primary and secondary wound on bakelite tubes. Primary tapped for fine tuning. 3/16 inch shaft. Range 180 to 650 meters.

### MOULDED VARIOMETER

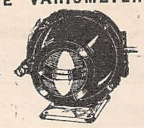


M412 Each ...$2.30
Polished black moulded rotor and stator forms. Maximum inductance with greatest efficiency and minimum distributed capacity. A high grade instrument that will get the best results. Wave length 180 to 600 meters.

### EXCEL 180° VARIOCOUPLER

M521 Each .....90c
A wonderful value. Produces excellent results. Green silk windings. Rigid mounting support. Primary tapped for fine tuning. ¼ inch shaft. Range 200-600 Meters.
M522 Variometer—same style. Each .....90c

### SUPERIOR BAKELITE VARIOMETER

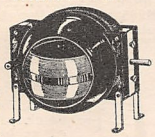


M525 Each .....$3.35
Forms moulded of red bakelite. A neat handsome instrument. Green silk windings calculated for highest efficiency. ¼ inch shaft. Noiseless pigtail connections. Produces superior results in any type circuit 180 to 650 meters.
M527 Variocoupler. Same style. Primary tapped for fine tuning. Each.....$3.68

### SUPERIOR VARIOCOUPLER

M523 Each .....$3.35
Stator tube and rotor ball of moulded red brown bakelite. Large size green silk windings insure highest efficiency. ¼ inch shaft. Superior results in circuits for 180 to 650 meters. Tapped primary for finest tuning. Noiseless contacts.
M526 Special type for single circuit Regenerative Hook up. Each.....$3.75

### SPLIT STATOR VARIOMETER



M524 Each ...$3.65
A wonderful value at our price. Polished black bakelite rotor and stator forms. Large size green silk wire insures greatest efficiency. ¼ inch shaft. Noiseless pigtail connection. Split stator winding.

### PFANSTIEHL SPIDER WEB VARIOMETER AND VARIOCOUPLER

M406 Variometer. Each.$3.95
M407 Variocoupler. Ea. 4.15
Sharp tuning, high efficiency and responsiveness to distant signals are features of these instruments due to absence of any insulating material in the magnetic field. Low energy loss. Secondary adjustment provides sharp tuning. Panel or table mounting. Complete with dial.

### COTO COMPACT VARIOMETER AND VARIOCOUPLER

M408 Variometer. Ea. ...$4.10
M409 Variocoupler. Ea. .. 4.35
Small in size. Highly efficient. Unequaled for portable sets. Variometer measures 2⅞x1⅝x3¾ inches. Variocoupler 2⅞x3x3¾. Moulded bakelite forms. Silk covered windings. Table or panel mounting. ¼ inch shafts. Range 200 to 600 meters.

### SWITCH LEVERS

Very neat polished composition knob. Exposed metal parts polished nickel finish. Fitted with panel bushing and two set nuts. A high grade switch. 1¼ inch radius.
M381 With black knob. Ea.14c
M382 With mahogany knob. Each.....18c

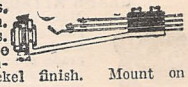
### INDUCTANCE SWITCH

M285 Price including knob and dial .....$1.18
Mounts switch points and contact lever behind panel. Only one hole needed to mount. 12 switch points, any number of which may be used.

### SPIDER WEB COILS

M290— 25 turn 39c M292—50 turn 47c
M291— 35 turn 42c M293—75 turn 54c
M294—100 turn. Each .....68c
A new popular type of inductance of highest efficiency. Lowest distributed capacity and lowest high frequency resistance. Firm green silk windings with mounting strips.

### SUPERIOR RADIO JACKS

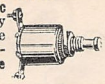


Finest grade jacks. Improved design. Best materials. Phosphor bronze springs. Silver contact points. Nickel finish. Mount on panels ⅛ to ⅜ in.
M390 Open circuit. Each.....32c
M391 Closed circuit. Each .....39c
M392 Two circuit. Each .....49c
M393 Single circuit filament control..46c
M394 Two circuit filament control....59c

### RADIO SWITCH

M287 Each .....25c
Cuts current on and off instantly by a push or pull. Very neat. Well made. Durable. Saves tubes and batteries.

### SUPERIOR RADIO SWITCH

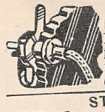


M283 Each .....25c
A switch fully equal to any on the market at a price about half what is usually asked for a switch of anywhere near equal quality.

### NEW STYLE JACKS

M379 Single circuit. Each..24c
M380 Double circuit. Each..49c
Occupy less space than other jacks. Binding posts, soldering unnecessary. Well made, durable smooth working. Well insulated.

### CORD TIP JACKS

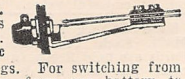


M389 Pair .....20c
Eliminates expensive jacks and plugs. Mount on panel and insert headset or loud speaker cord tips. Nickel finish.

### STANDARD JACKS

M387 Open circuit jack. Each.....22c
M388 Two circuit jack. Each.....28c
Well made, durable, smooth working, nickel finished frame. Well insulated.

### JACK SWITCHES



M280 Two springs. Usually used as "A" battery switch. Each .....47c
M281 Three springs. For switching from long to short wave, from one battery to another, etc. Each .....55c

### INDUCTANCE COILS (Honeycomb)

Carefully made—fine looking coils. Low resistance—high self inductance. Very firm impregnation. Mounted coils have standard plug mountings. Specify when ordering whether mounted or unmounted type is wanted.

| Tns | Art No. | Not Mtd | Mtd | Tns | Art No. | Not Mtd | Mtd |
|---|---|---|---|---|---|---|---|
| 25 | M301 | $.28 | $.75 | 200 | M307 | $.66 | $1.20 |
| 35 | M302 | .30 | .90 | 500 | M311 | 1.06 | 1.57 |
| 50 | M303 | 32 | .96 | 1000 | M314 | 1.64 | 2.18 |
| 75 | M304 | .37 | 1.02 | 1250 | M315 | 1.86 | 2.35 |
| 100 | M305 | .52 | 1.07 | 1500 | M316 | 2.10 | 2.50 |

### INDUCTANCE COIL MOUNTINGS

M340 3 Coil..$2.75 M341 2 Coil..$2.35
Made of polished black bakelite. Mount on front of panel.
M342 Mounts back of panel, with knobs or dials on front of panel. Takes 3 coils of any size. Each .....$3.25

### MAGNET WIRE

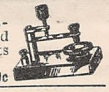
Prices quoted are for 8 oz. spools unless otherwise stated. Prices are prepaid.

| Double Cotton White | Enameled | Wire Size | Single Silk Green | Double Silk Green |
|---|---|---|---|---|
| M990 | M992 | | M991 | M993 |
| 39c | 31c | 18 | 54c | 75c |
| 43c | 35c | 20 | 60c | 82c |
| 49c | 39c | 22 | 70c | 95c |
| 57c | 45c | 24 | 85c | $1.05 |
| 70c | 50c | 26 | 95c | 1.30 |
| 95c | 55c | 28 | $1.15 | 1.60 |
| $1.15 | 60c | 30 | 4oz. .80 | 4oz. 1.10 |
| 1.49 | 65c | 32 | 4oz. .95 | 4oz. 1.30 |
| | 85c | 36 | 4oz. 1.95 | 4oz. 2.60 |

### BAKELITE TUBING

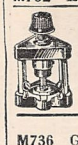
Genuine bakelite tubing. Pieces 3 inches long only.
M985 Inside dia. 2½ in..29c
M986 Inside dia. 3 in....35c
M987 Inside dia. 3½ in.....38c
M988 Inside dia. 4 in.....43c

### GALENA DETECTOR



Easy fine adjustment. Crystal mounted in cup. Moulded base and knob. Brass parts polished nickel finish.
M732 Each .....59c

### FRESHMAN DETECTOR



M760 Each .....$1.10
A double adjustable crystal detector especially suitable for reflex and other sets requiring a high grade detector. For front or back of panel mounting.

### DETECTOR CRYSTALS

M736 Galena, Arlington tested, piece 19c
M738 Silicon, Arlington tested, piece 19c
M735 Tested Galena, Mounted, piece 9c
M737 Tested Silicon, per piece..... 9c
M746 Dutec Crystal. Each .....27c

### STANDARD BRAND FIXED CRYSTAL DETECTORS

The latest developments in Crystal Detectors. Used in Reflex circuits.
M742 Grewol Detector. Each.....$1.10
M747 RW Detector ..... 1.15
M749 Brownlie Detector ..... 1.79
M750 Brownlie Renewal ..... .69

### DUBILIER MICADON TYPE 601

M502 .0001..28c M507 .0025.32c
M503 .00025..28c M508 .003..40c
M504 .0005..28c M509 .004..40c
M505 .001...32c M510 .005..48c
M506 .002...32c M511 .006..57c

### DUBILIER MICADON 601G

Same style condenser as above with mounting for tubular grid leak. No grid leak included.
M581 .00025. Ea. .....36c
M582 .0005 Ea. .....36c

### DUBILIER MICADON 601T

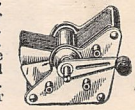
Consists of a Type 601 condenser with brackets designed to fit over terminals on audio frequency transformers, binding posts, etc.
M583 .001 mfd..40c
M584 .002 mfd..40c M585 .0025 mfd..40c

### PANEL MOUNTING VARIABLE CONDENSERS

These are especially high grade condensers and we guarantee them to be mechanically and electrically perfect. Fine polished end plates of heavy bakelite. Shafts ¼ inch diameter. Sturdy, heavy aluminum alloy plates perfectly spaced to insure smooth, even reliable capacity. Dial and knob on vernier type. No dial on plain type. Our low prices save you money.

| No. Plates | Max. Cap. | Plain Type No. | Plain Type Price | Vernier Type No. | Vernier Type Price |
|---|---|---|---|---|---|
| 3 | | M815 | $.58 | | |
| 5 | | M816 | .97 | | |
| 11 | .00025 | M814 | 1.13 | M825 | $1.95 |
| 17 | .00035 | M817 | 1.20 | | |
| 23 | .0005 | M813 | 1.27 | M824 | 2.30 |
| 43 | .001 | M812 | 1.40 | M826 | 2.45 |

### LOW LOSS VARIABLE CONDENSERS



The latest type condensers. Reduce current losses increasing efficiency of set. Heavy aluminum plates. Vernier type has single vernier plate controlled by lever. ¼ inch shaft. 3 inch dial required for vernier type.

| No. Plates | Max. Cap. | Plain Type No. | Plain Type Price | Vernier Type No. | Vernier Type Price |
|---|---|---|---|---|---|
| 11 | .00025 | M836 | $1.90 | M833 | $2.18 |
| 23 | .0005 | M837 | 2.12 | M834 | 2.90 |
| 43 | .001 | M838 | 2.90 | M835 | 3.85 |

### GROUNDED ROTOR LOW LOSS VARIABLE CONDENSERS

M797 .0003 .....$2.74
M798 .0005 ..... 3.30
M799 .001 ..... 3.90
The most efficient type condenser made. Low losses, grounded rotor, straight wave line. Made of the best grade materials throughout. Heavy aluminum plates. Well insulated.

### STANDARD BRAND VARIABLE CONDENSERS

M810 Acme .0005 Vernier.....$5.65
M784 Coto .00025 Vernier ..... 3.90
M785 Coto .0005 Vernier ..... 4.18
M786 Coto .001 Vernier ..... 4.98
M820 Remler .00035 ..... 4.45
M821 Remler .0005 ..... 4.45
M787 Cardwell .00025 ..... 3.95
M788 Cardwell .00035 ..... 4.35
M789 Cardwell .0005 ..... 4.60
M790 Cardwell .001 ..... 5.55
M791 Marco .00025 ..... 3.95
M792 Marco .00035 ..... 4.45
M793 Marco .0005 ..... 4.95
M794 Marco .001 ..... 5.85
M795 Flewelling .00025 Vernier .... 4.50
M796 Flewelling .0005 Vernier .... 4.95

### FRESHMAN VARIABLE GRID LEAKS

M177 Back of panel style 47c
M178 Back of panel style with .00025 Condenser....69c
M171 Base mounting type with .00025 Condenser....69c

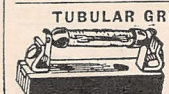
### C R L VARIABLE GRID LEAK

M173 Without condenser but arranged to take any standard grid condenser .....$1.05
M175 With .00025 condenser ..... 1.35
Turning knob varies resistance from ¼ to 8 megohms.

### BRADLEYLEAK

Latest improved type.
M168 Without condenser. Resistance ¼ to 10 megohms....$1.74
M169 With .00025 condenser 1.95

### TUBULAR GRID LEAKS AND CONDENSERS



Cut shows leak or condenser mounted, but all parts are priced separately.
M849 Grid leaks can be used with Dubilier 601G condensers) .....10c
Resistances ½, 1, 1½, 2, 3, 5, 7 and 10 megohms. **Specify resistance.**
M831 Grid and Plate Condensers. Ea...29c
Capacities .000025, .0001, .00025, .0005. Specify capacity.
**Mountings**—Bakelite Base
M840 Single. Each.....15c
M842 Double. Each.....27c
M844 Triple. Each.....39c

### TINNED COPPER "BUS BAR" WIRE

Size 14 tinned copper wire. For wiring sets. Best size for neat job and easy soldering.
M957 Round. Ten feet for.....10c
M958 Square. Ten feet for.....11c

### SPAGHETTI

For covering connecting wires in sets. For size 12 and 14 wires.
M955 Finest quality braided and saturated with best baked lustrous transparent insulating varnish, 3 feet for.....14c
M956 Best quality braid and covered with black insulating compound. 3 feet for..8c

The Barawik Co.
102 So. Canal St. Chicago, Ill.

# With Barawik Standard Radio Goods

BARAWIK — SERVICE

We have many thousands of customers all over the world. You take no risk in dealing with us. We are one of the oldest and most reliable radio supply houses. "RADIO NEWS" guarantees our reliability. Let us serve you and save money for you. All orders shipped same day received.

### VACUUM TUBES

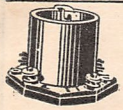
Standard Brands—Cunningham, Radiotron. Every one guaranteed new and perfect and in original carton. We will ship brand in stock unless you specify otherwise.

M105 Detector, UV200, C300. Each .....$3.59
M112 Amplifier, UV201A, C301A. Each ..... 3.59
M118 5-Watt Transmitter.. 7.70
M107 WD11, C11. Each.. 3.59
M101 WD12, C12. Each.. 3.59
M102 UV199, C299. Each 3.59

### ADAPTERS

To use dry cell tubes in standard base sockets simply insert one of these adapters in the socket.
M104 For 199 or 299 tubes...35c
M109 For WD11 or C11 tubes 35c

### BAKELITE SOCKET



M140 Standard base ..27c
M141 UV199 base.....27c
M136 C11 .....27c
Moulded of genuine red brown bakelite. Binding post connections. Strong contacts. Real values.

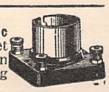
### EXTRA STRONG SOCKET

M142 Standard base ....38c
M138 C299 Base .....38c
Extra heavy. Square base. Double reinforced contact springs. For standard base tubes. A wonderful value.

### PANEL MOUNT SOCKET

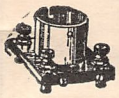
M143 Single Gang ...$.42
M144 Three Gang ....1.39
The best socket value obtainable anywhere. Extra heavy, moulded, genuine brown bakelite. Double reinforced contact springs. Will mount on panel behind rheostat. Standard base.

### METAL TUBE SOCKET



M134 Each .....25c
Nickel plated brass tube set in best grade composition base. Plainly marked binding posts. An excellent value.

### STANDARD TUBE SOCKET



M150 Single Gang..$.76
M153 Three Gang...2.25
Bakelite base. Polished nickeled tube. Highest quality socket on the market. Best insulation. Positive contact. Marked terminals. For base or panel mounting.

### CUSHION BASE SOCKET

M145 199 Base .....59c
M146 Standard Base ....75c
Moulded of high insulating material. Sponge rubber base. Non microphonic. Plainly marked binding post connections. Neat and compact.

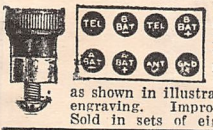
### BINDING POSTS

Brass, polished nickel finish. Washer and 6-32 in. screw extending ⅝ in.

M370 Large size — barrel and knob ¾ in. long. Dozen ...70c
M372 Smaller size barrel and knob 9-16" long. Dz. 50c

M376 Large size with hole for phone tip or wire. Dozen ...80c
M378 Small size with hole for phone tip or wire Dozen .....35c

### LETTERED BINDING POSTS




M375 Set of eight ...39c
Nickel plated washers. Composition tops lettered as shown in illustration. Eliminate engraving. Improve appearance. Sold in sets of eight only.

### COMPOSITION TOP BINDING POSTS

M374 Dozen 45c Hundred $3.00
Composition top, nickel plated body. 6/32 screw with washer.

### SWITCH CONTACT POINTS

Brass polished nickel finish. Have ⅝ in. long size 6/32 screws and two nuts.
M363 Dozen...10c Hundred...75c
Thousand $6.75

### Solder Lugs to Fit Contact Points

Also for connecting wires to binding posts, etc.
M305 Dozen...8c Hundred...30c

### SWITCH LEVER STOP

Brass polished nickel finish.
M386 Dozen...15c Hundred...$1.05

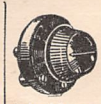
### BRASS ROD

M961 Threaded 6-32, per 8 in. length..6c
M963 Threaded 8-32, per 8 in. length..8c
M965 Solid 3-16 in., per 8 in. length..6c
M967 Solid ¼ in., per 8 in. length...9c

### COPPER FOIL

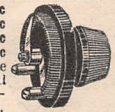
M968 Per piece .....25c
Thin copper foil for shielding panels. 6 inches wide, 2 feet long, .005 in. thick.

### SUPERIOR RHEOSTATS



M147 6 ohm. Each....60c
M148 20 ohm. Each....65c
M149 30 ohm. Each....70c
One of the finest rheostats we have ever seen at a price that makes it the best value obtainable anywhere. Genuine bakelite base. Beautifully shaped black bakelite knob with white arrow. Single hole mounting. A rheostat you will be proud to have in your set.
M156 400 ohm Potentiometer. Matches above rheostats. Each .....89c

### FILAMENT CONTROL RHEOSTATS



M132 6 ohm. Each...32c
M129 20 ohm. Each...35c
M131 30 ohm. Each...38c
M135 6 ohm Vernier..78c
Best grade. Will give real service. Durable and lasting. High heat resisting base, diam. 2⅛ in. Tapered polished black knob 1¼" diam. **Potentiometers.** Match above rheostats. Same high grade construction.
M151 200 ohm. Ea. 50c M152 400 ohm. Ea. 58c

### OUR SPECIAL A. F. TRANSFORMER

M549 3 to 1 ratio..$2.25
M550 5 to 1 ratio.. 2.45
In quality of tone and volume of sound, the things a transformer is built for we guarantee it to equal or surpass any other transformer. Neat in appearance. Carefully made. Fully mounted with plainly marked binding post connections. Wonderful results on one, two or three steps without distortion or howling. A quality item in every respect.

### TRICOIL R. F. TRANSFORMER

M560 For 201A or 301A Tubes .....$1.58
M561 For 199 or 11 or 12 Tubes ..... 1.58
This transformer will produce wonderful results in any type of regular or reflex radio frequency circuit. Perfect for one, two or three stages. Compact, convenient form, easily mounted. Range 175 to 600 meters.

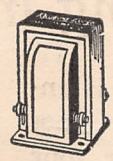
## Super-fine Radio Parts

## ALL-AMERICAN

**All-American products are known the world over for their high quality. Every item is fully guaranteed to give satisfactory service.**

### AUDIO FREQUENCY TYPE

M626 Super Het. Oscillator Coupler .....$5.00
M627 Input transformer .....$5.40



M628 Universal Coupler. For use in reflex and other circuits .....$3.60

M625 Intermediate frequency transformer for super heterodyne circuits ....$5.40

| | | | |
|---|---|---|---|
| M531 | 10 to 1. Each .....$4.25 | Rauland Lyric. A transformer designed to reproduce music and voice with all its original purity of tone. M535 Ea....$8.10 | M629 Short wave R. F. transformer, range 250 to 550 meters. For 201A tubes $4.50 |
| M532 | 5 to 1. Each .....$4.25 | | M630 For 199 tubes only $4.50 |
| M533 | 3 to 1. Each .....$4.05 | | |
| M534 | Push Pull. Pair .....$10.80 | | |

### HOWARD RHEOSTATS

A well known line of rheostats and potentiometers that is giving very satisfactory service to its users. Complete with knob and pointer.

M211 Plain 85c 6 ohm M212 Vernier $1.25
M213 Plain 85c 25 ohm M214 Vernier 1.25
M215 Plain 85c 40 ohm M216 Vernier 1.25
M218 400 ohm Potentiometer ..... 1.69

**Single Hole Mounting Type with Dial**

M350 Plain 85c 6 ohm M351 Vernier $1.25
M352 Plain 85c 25 ohm M355 Vernier 1.25
M354 Plain 85c 40 ohm M355 Vernier 1.25
M357 400 ohm Potentiometer ..... 1.69

### BRADLEYSTAT and BRADLEYOMETER

M208 Bradleystat. Each.....$1.74
Latest improved type. Can be used with all types of tubes.

**Bradleyometer**
M209 200 ohm. Each.....$1.89
M210 400 ohm. Each..... 2.89

### ACME POT-RHEO.

A rheostat and potentiometer combined in one unit. Does the work of two separate instruments. 300 ohm potentiometer.
M237 With 6 ohm rheostat.....$2.69
M238 With 30 ohm rheostat..... 2.69

### AMPERITES

Eliminates rheostats on amplifier tubes where adjustment is not critical. Automatically adjust resistance according to flow of current, keeping tubes at proper point for maximum efficiency. Complete with mounting.
M221 For UV201A or 301A tubes....95c
M222 For UV200 or C300 tubes.....95c
M223 For UV199 or C299 tubes.....95c
M224 For WD11 or C11 tubes.....95c
M599 Erla Selectoformer .....$4.45
M740 Erla Crystal Detector..... .89

### OTHER STANDARD BRAND AUDIO FREQUENCY TRANSFORMERS

Fresh, Clean Stock in Original Containers.
M587 Thordarson Ratio 3½ to 1....$3.30
M588 Thordarson Ratio 6 to 1..... 3.70
M589 Thordarson Ratio 2 to 1..... 3.95
M590 Thordarson Push Pull. Pair..11.20
M553 Acme ..... 3.95
M597 Erla 6 to 1..... 4.05
M598 Erla 3½ to 1..... 3.60
M591 Modern 10 to 1. Each..... 4.50
M592 Modern Push Pull. Pair..... 9.90
M555 Federal No. 226. Each..... 4.45
M556 Federal No. 65. Each..... 6.35
M712 Radio Corp. Each..... 5.70

### STANDARD BRAND RADIO FREQUENCY TRANSFORMERS

M562 Dubilier Duratran .....$3.45
M565 Acme R2 ..... 3.95
M566 Acme R3 ..... 3.95
M567 Acme R4 ..... 3.95
M538 Erla Reflex No. 1..... 4.45
M579 Erla Reflex No. 2..... 4.45

### RESISTANCE COUPLED AMPLIFICATION

M570 1st Stage Unit $2.30
M571 2nd Stage Unit 2.30
M572 3rd Stage Unit 2.30
Amplifies without distortion. Replaces audio frequency transformers using same circuit. Each unit consists of a mounting with condenser, grid leak and resistance of proper value for best results.

### INSULATED BUS BAR WIRE

M959 Package of 5 30-inch pieces...49c
Tinned copper bus wire insulated with highest grade varnished covering. 5 pieces, one each color—yellow, brown, black, green and red. Using different colors makes tracing of circuits easy and sure, neater and lower cost.

### SCREW ASSORTMENT

M960 100 pieces screws and nuts....39c
Contains screws and nuts of size and style needed for assembling any radio set.

### RADIO "BAKELITE" PANELS

We supply genuine Bakelite, Condensite Celeron or Formica, all of which have practically identical properties. Machines well without chipping. Won't warp. Waterproof. One side has attractive natural polished black finish which can be sanded and oiled. Other side mahogany finish. Either side may be used as rront.

| Panel Size Inches | ⅛" thick Art. No. | Price | 3/16"thick Art. No. | Price | ¼"thick Art. No. | Price |
|---|---|---|---|---|---|---|
| 6x 7 | M450 | $.55 | M460 | $.89 | M470 | $1.15 |
| 6x10½ | M451 | .86 | M461 | 1.10 | M471 | 1.60 |
| 7x10 | | | M455 | 1.28 | | |
| 7x12 | | | M456 | 1.64 | | |
| 7x14 | M458 | 1.38 | M468 | 1.73 | M478 | 2.35 |
| 7x18 | M453 | 1.78 | M463 | 2.27 | M473 | 3.15 |
| 7x21 | M457 | 2.05 | M467 | 2.65 | M477 | 4.10 |
| 7x24 | M459 | 2.42 | M469 | 2.97 | | |
| 7x26 | | | M462 | 3.25 | | |
| 9x14 | | | M464 | 2.35 | M474 | 3.15 |
| 12x14 | | | M465 | 2.97 | M475 | 3.98 |
| 12x21 | | | M466 | 4.25 | M476 | 5.70 |

### RUBBER COMPOUND PANELS

Made of a special compound having a rubber base. Equal in appearance and in all essential points to any other class of panels. Fine smooth polished finish. Can be drilled or cut without chipping. Guaranteed not to warp and to be a perfect insulator for radio use. Smooth, clean edges. Thickness 3/16 inch.

| Art. No. | Black Price | Size Inches | Art. No. | Mahogany Price |
|---|---|---|---|---|
| M481 | $ .60 | 7x10 | M493 | $ .75 |
| M482 | .77 | 7x12 | M494 | .92 |
| M483 | .89 | 7x14 | M495 | 1.09 |
| M484 | 1.19 | 7x18 | M496 | 1.34 |
| M485 | 1.32 | 7x21 | M497 | 1.55 |
| M486 | 1.50 | 7x24 | M498 | 1.75 |

### COMPOSITION DIALS

Handsome dials moulded in one piece of polished composition. 2 inch size has 270° scale marked 0 to 100 finely engraved in contrasting white enamel. 3 and 4 inch sizs have 180° scale marked 0 to 100.

| No. | Black Price | Diam. | Shaft Size | Mahogany No. | Price |
|---|---|---|---|---|---|
| M921 | 16c | 2" | 3/16 | M926 | 19c |
| M922 | 16c | 2" | 1/4 | M927 | 19c |
| M923 | 22c | 3" | 3/16 | M928 | 26c |
| M924 | 22c | 3" | 1/4 | M929 | 26c |
| M925 | 27c | 4" | 1/4 | M930 | 32c |

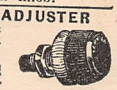
### GENUINE BAKELITE DIALS

M931 2 in. Diam. for 3-16 in. shaft..35c
M932 2 in. Diam. for ¼ in. shaft....35c
M933 3 in. Diam. for 3-16 in. shaft..39c
M934 3 in. Diam. for ¼ in. shaft....39c
M935 4 in. Diam. for ¼ in. shaft. Ea.48c
Moulded in one piece of genuine bakelite in polished black finish. Finely engraved scale in contrasting white enamel. Sure grip knob that fits the fingers. Higher grade dials for good sets. Match perfectly.

### VERNIER DIAL ADJUSTER

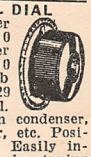
M941 Each .....14c
Easily installed at edge of dial, gives finest vernier adjustment of condenser or inductance. A great value. Polished black knob.

### SUPERIOR VERNIER ADJUSTER



M942 Each .....26c
Polished black knob. "Vernier" engraved in white. Spring adjustment. Need not be disassembled for mounting. Easily installed.

### UNIVERNIER CONTROL DIAL



M918 For 3/16 in. shaft, silver dial, black knob .....$1.10
M919 For ¼ in. shaft, silver dial, black knob .....$1.10
M916 Gold dial, mahogany knob for ¼ in. shaft. Each.....$1.29
Replaces ordinary knob or dial. Gives perfect vernier control on condenser, variometer, variocoupler, tickler, etc. Positive easy action. Looks fine. Easily installed. Especially desirable in tuning neutrodyne sets.

### ACCURATUNE CONTROL DIAL

M914 Clockwise...$3.20
M915 Counterclockwise ..... 3.20
Has four inch silver finished dial with black knob. 80 to 1 ratio give finest tuning adjustment.

### BEZELS

Finest quality. Fit any thickness panel.

| Size In. | Nickel No. | Price | Black No. | Price | Gold No. | Price |
|---|---|---|---|---|---|---|
| ¾ | M904 | 15c | M907 | 16c | M910 | 28c |
| 1 | M905 | 15c | M908 | 16c | M911 | 28c |
| 1½ | M906 | 15c | M909 | 16c | M912 | 28c |

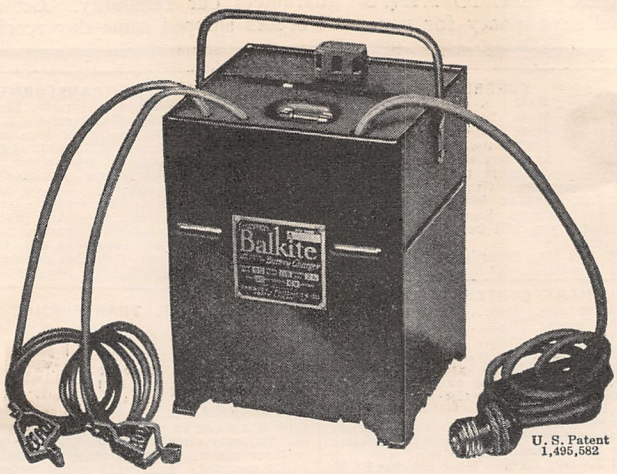
### PANEL ENGRAVINGS

M937 Per set .....19c
A complete set of transfers in neat white lettering for marking connections, dials, etc. Easily applied in a few seconds. Look like real machine engravings, contrasts neatly on black or mahogany panels. Plenty of titles for the largest set.

## The Barawik Co.

102 So. Canal St. Chicago, Ill.

TESTED AND LISTED AS STANDARD BY UNDERWRITERS' LABORATORIES




# *A noiseless* battery charger

## *simple, efficient and unfailing in operation*

The Balkite Battery Charger is entirely noiseless. Its operation does not disturb the operation of either your set or your neighbor's. It can be used while the set is in use. It has no bulbs, vibrators or moving parts, and nothing to adjust, break or get out of order. It cannot deteriorate through use or disuse. It delivers a taper charge, will charge a completely discharged battery, and cannot discharge, short circuit, or damage the battery by overcharging. It needs no attention other than an occasional filling with distilled water. It is unaffected by temperature or fluctuations in line current. It is simple, efficient and unfailing in operation.

The Balkite Battery Charger charges the ordinary 6-volt radio "A" battery from 110-120 AC 60 cycle current. Special model for 50 cycles. Without added attachments it will also charge "B" batteries of the lead type in multiples of 6 cells. Special adapter for charging 2 and 4-volt batteries—$1.50.

*Sold by leading radio dealers everywhere*

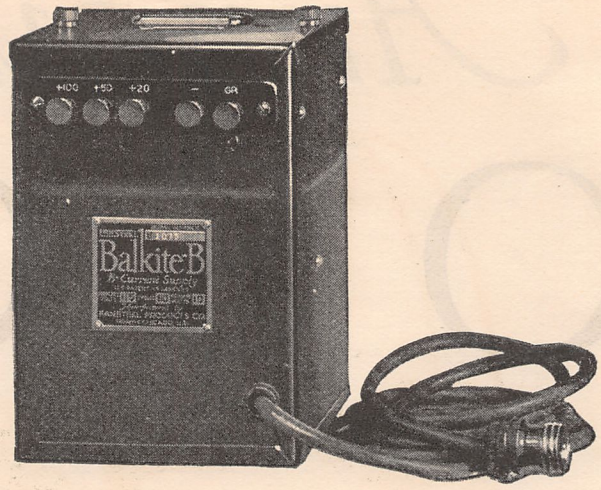
*Manufactured by* FANSTEEL PRODUCTS CO., Inc., *North Chicago, Ill.*

FANSTEEL

# Balkite *Battery Charger*

*Price* $19.50

West of the Rockies $20 · In Canada $27.50




# Balkite "B" replaces the "B" Battery

***and supplies plate current from the electric lighting circuit***

## How Balkite "B" Operates

Balkite "B" is based on the same principle as the Balkite Battery Charger. It rectifies the alternating current of the lighting circuit and gives the direct current necessary for tube operation. No additions or changes in the set are necessary with its use. The binding posts provided are simply connected to the corresponding connections on the set, and the plug provided is connected to a convenient light socket. It operates with either the storage battery or dry cell type of tube. The current consumption is very low, the cost of operation being less than 1/10 of 1¢ per hour. It operates from 110-120 AC 60 cycle current. Special model for 50 cycles.

***Price $55*** $75 in Canada

*For sale by all leading radio dealers*

Balkite "B" is a new and revolutionary invention in radio. It furnishes current to the plate [or B] circuit of the radio set from the house lighting circuit. It ends the nuisance of "B" Batteries and gives a positive, unfailing and convenient source of plate current supply. With its use there are no wet "B" Batteries to require constant recharging, and no dry "B" cells to replace. It keeps the "B" circuit always operating at maximum efficiency, for with its use the plate current supply is never low. It delivers to the set at all times the current given by four or five 22½ volt dry "B" cells when these are new and fresh. It is very simple in operation, and can be put in use at any time by merely connecting it to a light socket. It is entirely noiseless. It has no moving parts or bulbs, and nothing to break, wear out, adjust or get out of order. It cannot deteriorate through use or disuse. It requires no other attention than the addition of a few drops of distilled water once a year.

*Manufactured by* FANSTEEL PRODUCTS CO., *Inc.*, North Chicago, Illinois

FANSTEEL

# Balkite "B"

## *"B" Current Supply*

# *Announcing*

# BOSCH

**Absolutely Reliable**

**Backed by the Bosch Guarantee**

## Delivers "B" current from the electric light socket

# *the new*

# NOBATTRY

The Bosch Nobattry is a device which enables anyone to obtain from an electric light socket perfect and ample plate voltage for radio vacuum tubes. It takes the place of all "B" batteries and is decidedly more efficient, reliable, convenient and economical.

The Bosch Nobattry is a development of the American Bosch Magneto Corporation, which holds a supreme position in the production of fine electrical apparatus. Its great New England manufacturing plants, and its enviable reputation as a producer of high quality precision apparatus should establish immediate confidence in this latest development for the improvement of radio reception.

Do not confuse the Bosch Nobattry with other devices made for eliminating "B" batteries. It is radically different in design and construction, delivering an abundance of current at 15 to 150 volts.

Here's a new radio device you can buy with absolute confidence. It is of the same high quality as all Bosch electrical units, and is backed by the famous Bosch Guarantee of "satisfaction or your money back." Write for illustrated literature giving full particulars.

DEALERS: Don't delay—the demand is sure to be enormous. Wire today for sales proposition and discounts. State whether you are a dealer or jobber, and give references to aid us in quick allocation of territories.

PRICES

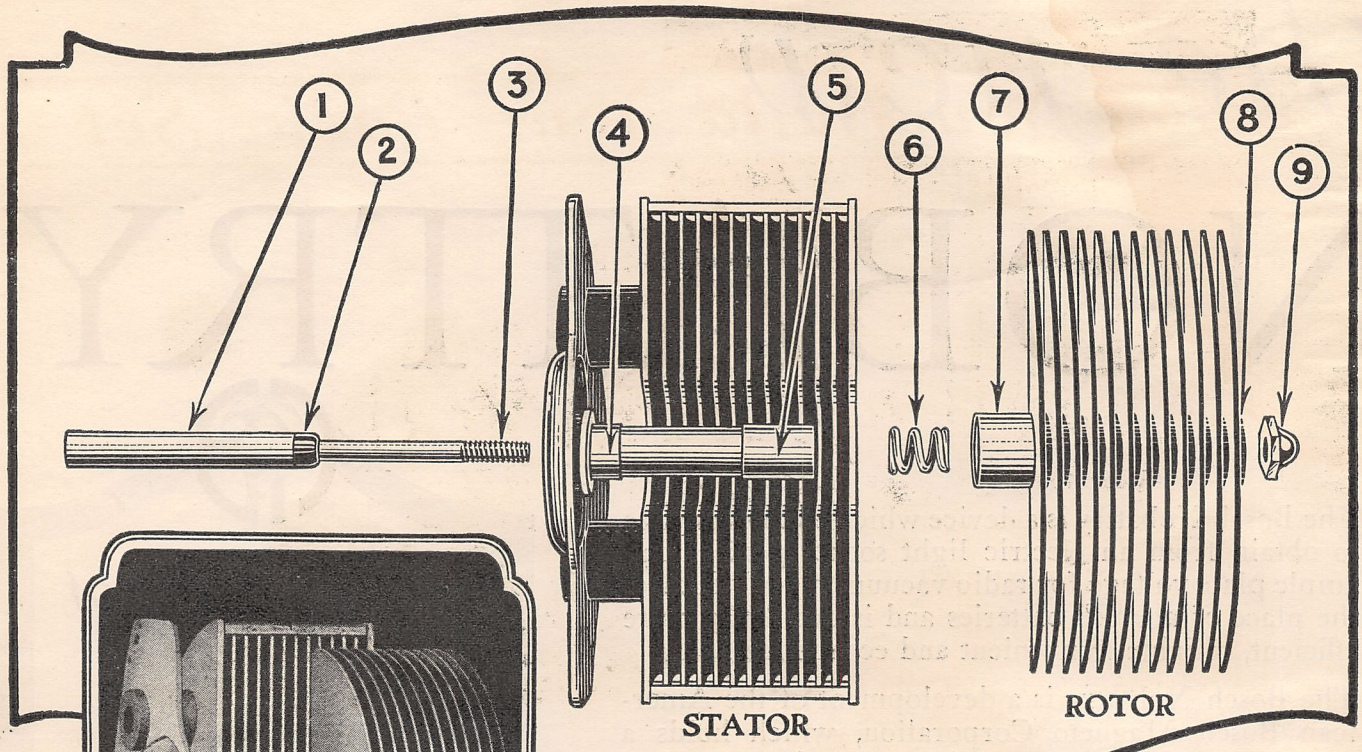
| | |
|---|---|
| Type BAN For Alternating Current - - - | $49.50 |
| Type BDN For Direct Current - - - - | 30.00 |

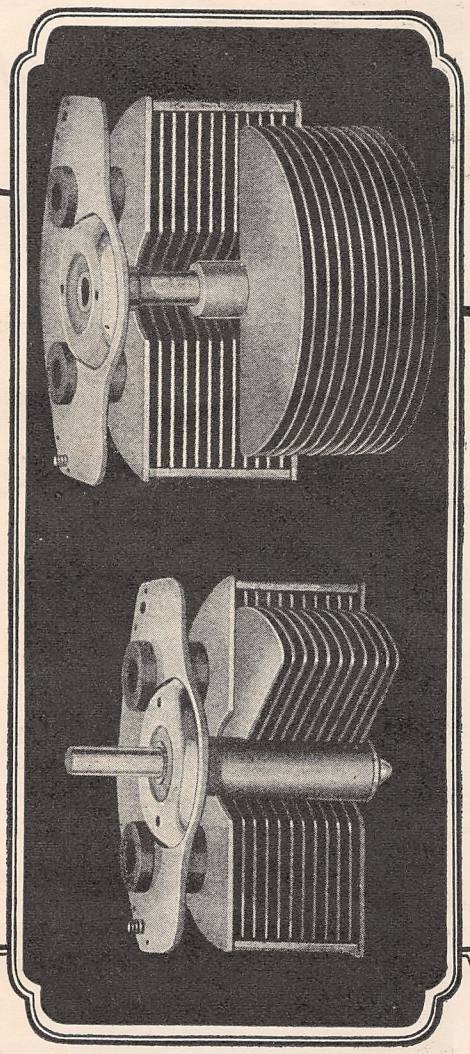
AMERICAN BOSCH MAGNETO CORPORATION
Main Office and Works, Springfield, Mass.

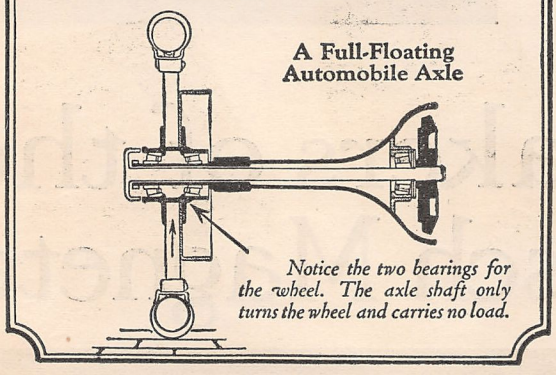
## *Chief Points of Superiority*

1. Suitable for any receiving set, using 1 to 14 tubes—will also take care of power amplifier.
2. Unlimited current supply.
3. Requires no attention—does not run down or wear out.
4. Cannot burn out radio tubes even if wrongly connected.
5. Uses no tubes—there's nothing to repair or replace.
6. Costs only a fraction of a cent to operate.
7. Detector voltage adjustable—from 15 to 50 volts.
8. Amplifier voltage adjustable, too—from 90 to 150 volts.
9. Constant voltage — plenty of pep.
10. Gives clear tone, greater volume, and more distance.
11. It is NOISELESS—there's absolutely no hum or distortion.
12. Will operate low power transmitting sets.

# Built by the makers of the world famous Bosch Magneto






# The Condenser with the "full floating axle"

The striking feature of the Bradleydenser is the rigid double bearing, based on the principle of the "full-floating" automobile axle, that eliminates the usual outer pivot-bearing for the rotor shaft, and still provides a non-sagging support that insures perfect alignment of the rotor plates.

The rotor plates, soldered on a long, hollow tube extending from [7] to [8], revolve on a hollow steel stem provided with *two* bearings [4] and [5]. The alignment and support of the rotor is independent of the condenser shaft [1], as shown by the first photograph at the left. The shaft [1] merely turns the rotor. It slips through the hollow steel stem and its threaded end [3] is secured to the rotor at [8] with the nut [9] as shown in the second photograph. The spring [6] prevents end-play.

This design, combined with the use of soldered brass plates, results in a rugged, long-life condenser of extremely high efficiency. For superior service use the Bradleydenser.

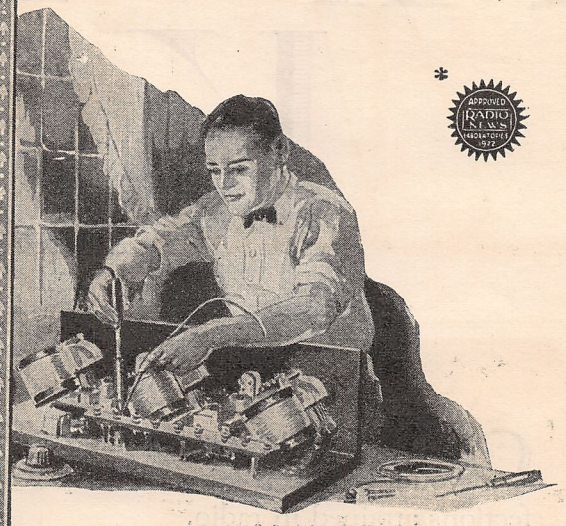
Allen-Bradley Co.
Electric Controlling Apparatus

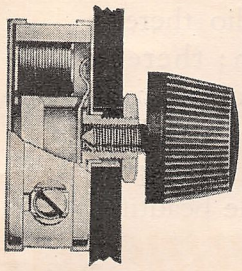
*General Office and Factory:* 287 Greenfield Ave., Milwaukee, Wisconsin

# Bradleydenser

## PERFECT VARIABLE CONDENSER

# Before You Build Your Radio Set





# See the New Allen-Bradley Line

Radio amateurs are building better receiving sets, today! They want greater distance, better selectivity and clearer reception.

The new Bradleystat, Bradleyleak, Bradleyohm, Bradleyometer and Bradleyswitch have met with instant favor, everywhere. In a superclass, by themselves, they are the exclusive choice of the discriminating amateur who has learned from experience that noiseless, stepless control is essential for perfect radio reception. Your set will work better with Allen-Bradley Radio Devices. For sale by leading dealers.

### *Distinctive Features*

1—Extremely compact without loss of control.

2—One-hole mounting for panels. Table mounting if desired.

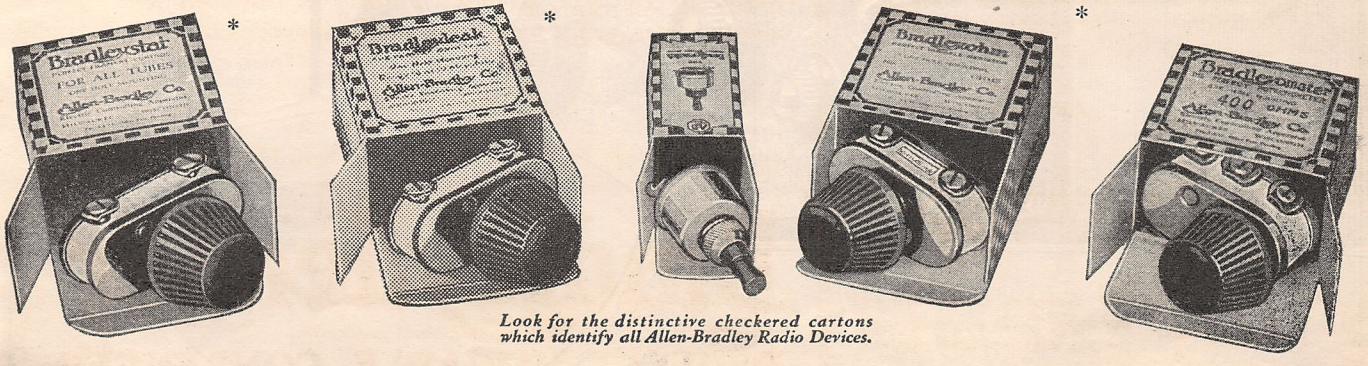
3—Noiseless, stepless control, due to graphite discs.

4—Guaranteed against defects in material and workmanship.

5—Sold in distinctive checkered cartons by leading radio dealers.

**Allen-Bradley Co.**
Electric Controlling Apparatus

*General Office and Factory:* 287 Greenfield Avenue Milwaukee, Wisconsin




*Look for the distinctive checkered cartons which identify all Allen-Bradley Radio Devices.*

# ATWATER KENT

## RECEIVING SETS

ONLY a great receiving set can give you a true realization of the perfections attained in radio.

There are wonderful things in the air. The latest and best in music, plays, lectures and news are being broadcast from everywhere. An ATWATER KENT will give you perfect command of them all.

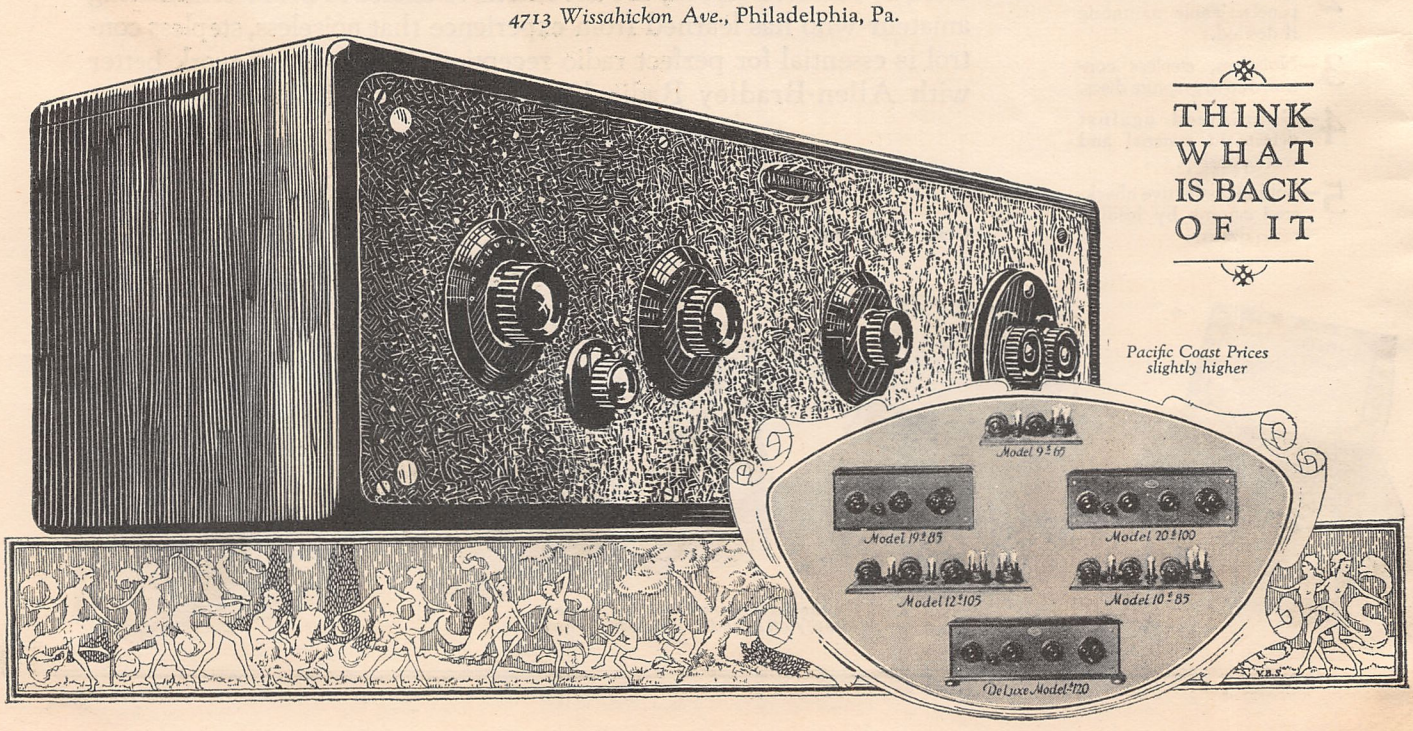
Night after night your ATWATER KENT will serve you faithfully, bringing in from where you will the programs you want to hear. It will give you the range to select what you want, the control to get it easily, and the volume and clarity to hear it perfectly.

In ATWATER KENT Radio there is quality beyond question; there is scientific, precise design and master workmanship. Experience, skill and knowledge are built into every part, from the tiniest wire to the beautiful, polished cabinet.

Any ATWATER KENT dealer will gladly demonstrate and help in your selection.

*Instructive literature on request*

ATWATER KENT MANUFACTURING COMPANY
*4713 Wissahickon Ave.*, Philadelphia, Pa.



# ATWATER KENT

## LOUD SPEAKERS

SET THE MUSIC FREE. There is a world of pleasure in the air. Set it free within your home. Let all your family share it with you through an ATWATER KENT Loud Speaker.

Here is the magic touch that makes your radio a living thing—that faithfully re-creates music with all the feeling of the artists who produce it . . . and adds a vivid realism to the plays, the sermons, the lectures and the daily news being broadcast every day and every night.

Rich in tone, full and clear in volume, the ATWATER KENT Loud Speaker opens up for everyone a new source of fascination and delight.

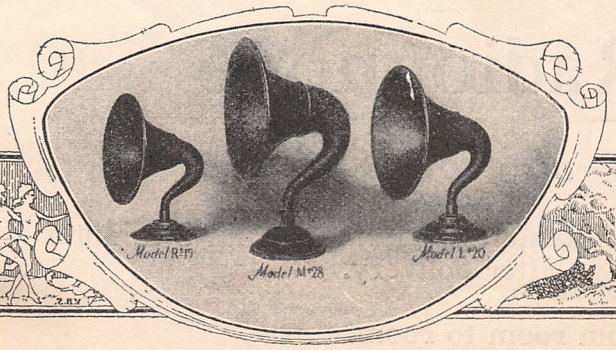
This masterpiece;—this priceless contribution to radio enjoyment is the product of the makers of ATWATER KENT Receiving Sets. Back of them is the accumulated experience of more than a quarter of a century in the manufacture of scientific electrical instruments.

Your dealer has three models. Hear one today.

*Instructive literature on request*

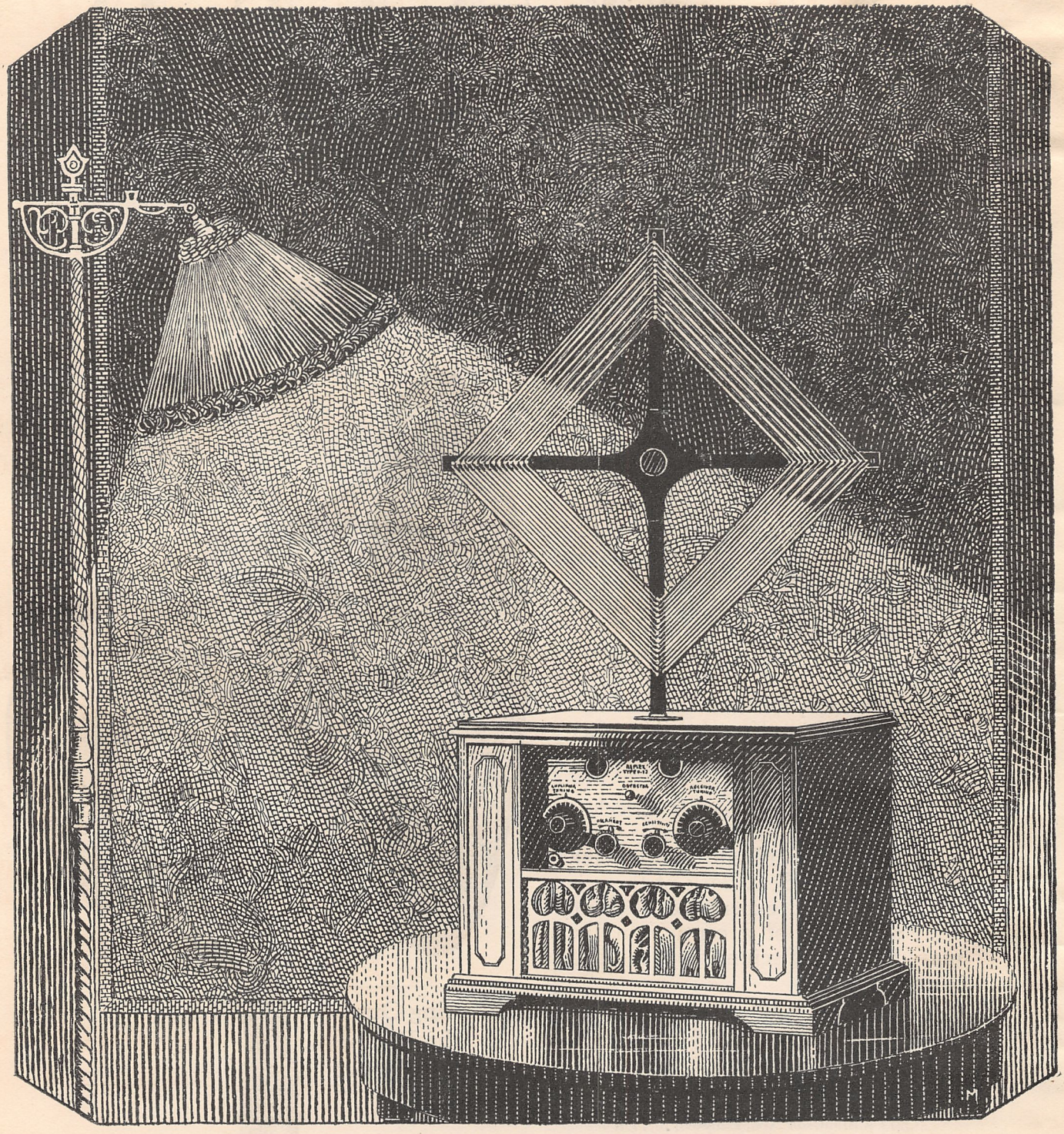
ATWATER KENT MANUFACTURING COMPANY
*4713 Wissahickon Ave., Philadelphia, Pa.*

**Bring Out the Best From Any Set**




*Pacific Coast Prices slightly higher*

# You have



# De Forest Radiophone

***Requires no aerial—no ground wire***

DeForest Loud Speaker and Tubes complete within cabinet.

Ready to operate within 5 minutes after delivery.

Easily movable from room to room.

# the radio habit now!

## *You'd better have a De Forest!*

WHETHER you have an instrument or not, whether you know it or not, you have the radio habit already. Do you go to the theatre? Do you go to political meetings? Do you read the day's news? Do you seek contact with people who offer either amusement or information? Then you're essentially a radio fan, for many of the best of these things radio is giving in a way that they cannot be obtained elsewhere.

Here is what De Forest is doing for radio.

The De Forest Radiophone is a complete and self-contained instrument with a loop the size of a picture frame instead of an aerial wire, with batteries self-contained.

It can be easily moved from room to room. It has a remarkable tone quality. It brings out the voice or instrument as sincerely and truthfully as the performer himself does—and clears itself (with the right dial settings) from disturbing or metallic noises. And it is an immediate result-getter that is simple to operate.

Whatever there is in radio, De Forest can give it to you. It yields good results from the beginning and gradually increasing results as your skill grows.

*There is nothing else like it.*

***It will pay you to look up a De Forest agent***

He is willing and equipped to teach you the simple technique of using the De Forest. Let him demonstrate it in your own home.

**DE FOREST RADIO CO.**
**Jersey City, N. J.**

***DV*-2**

***Your Tubes* are the key to your radio reception**

IF you know what the tubes do in a radio set, you'll know why nothing but De Forest Tubes will do.

USED as detectors or amplifiers, these tubes combine ideal operation with long life, sturdy strength and freedom from microphonic noises.

DV-2, for storage batteries, requires a filament potential of 4½ volts, and has a current consumption of 25/100 of an ampere.

DV-3, for dry batteries, requires 3 volts on the filament, and consumes 6/100 of an ampere.

***DV*-3**

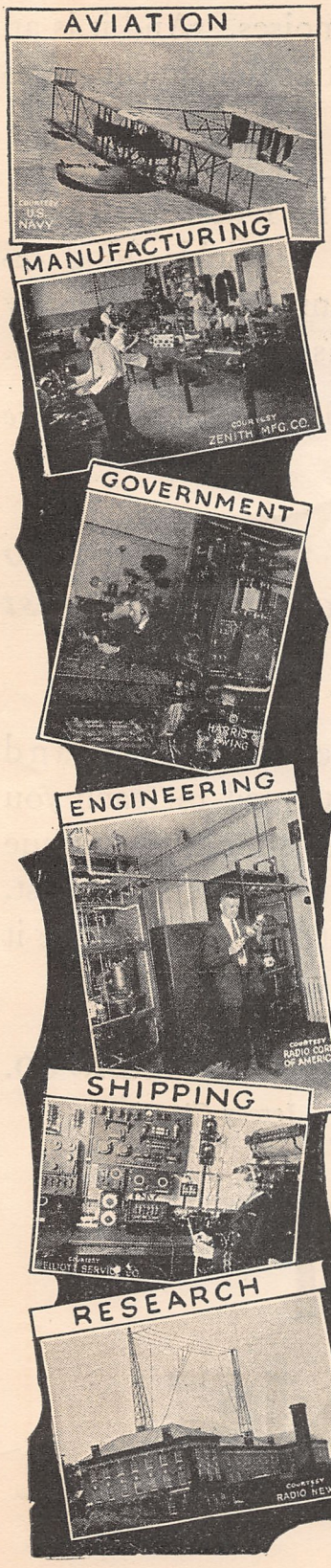
*The "Magic Lamp" of Radio*

# DE FOREST
REG. U.S. PAT. OFF.
# RADIOPHONE
REG. U.S. PAT. OFF.

# Earn $75 to $200 a Learn at Home

The astounding growth of Radio has created thousands of wonderful opportunities for earning big money. Millions upon millions of dollars are being spent every year since broadcasting has become so popular. Radio is indeed sweeping the world like a forest fire!

A few years ago only a very small number of men were actively engaged in Radio. Today, with but few exceptions, these men are holding key positions in this marvelous new industry. In the same way, the young men and ambitious boys who get into Radio now will be the leaders a few years hence. The opportunities right now are a hundred times greater than they were ten years ago.




## Recognized Radio Experts In Urgent Demand

Trained experts—not just half trained amateurs—are needed for the many big paying positions which have developed as a result of the tremendous expansion of Radio. Broadcasting stations are constantly needing operators, stores are sadly in need of trained experts as salesmen, installers, repair men, demonstrators. Factories need inspectors, assemblers, testers and executives.

These are just a few of the opportunities. Radio operators on board ship travel all over the world without one cent of expense, see historically important places, meet prominent people on board ship, mingling with the passengers and earning salaries equal to $200 a month in any land job. How often you've dreamed of travel, of being able to talk from experience of gay Paris, the beauties of the Mediterranean sunset, the awe of Egypt's pyramids. As a radio operator you can see them first hand.

## Hundreds of Big Paying Positions Open Right Now - in Radio!

Hardly a week goes by without our receiving calls for our graduates. This is how some of them read: "We need the services of a competent radio engineer"; "We want men with executive ability in addition to radio knowledge to become store managers"; "We require the services of several resident demonstrators."

## PROOF!

### Pay Increases Over $100 a Month

I am averaging anywhere from $75 to $150 a month more than I was making before enrolling with you. I would not consider $10,000 too much for the course.
(Signed) A. N. Long,
Greensburg, Pa.

### Doubles Salary

I can very easily make double the amount of money now than before I enrolled with you. Your course has benefited me approximately $3,000 over and above what I would have earned had I not taken it.
T. Winder,
731 Bedford Ave.,
Grand Junction, Colo.

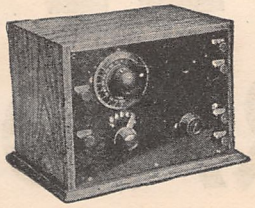
### $3500 First Year

When I enrolled with you I was a "buck private" in the army. No sooner had I received my discharge than I opened a Radio Shop of my own in my home town. I made over $3500 in one year working for myself. Now that I have the N. R. I. course beneath my hat, I wouldn't have missed it for a million dollars.
John P. Zinno,
Corona, L. I.

### Earns $50 to $83 a Week

I enjoyed every one of your lessons and had no trouble whatever. I earn $50 to $83 a week besides a commission on sales. Your course not only enabled me to get bigger pay but broadened my education as well.
Michael De Marco,
Boston, Mass.

## FREE Instruments



Tresco Reg. Licensed Armstrong U. S. Pat. No. 1,113,149

This 1,000-mile Regenerative receiving set is included in our course without charge. Our book, "Rich Rewards in Radio," tells you all about the practical training given with it.

# Week as a Radio Expert in Spare Time

## MORE PROOF!

### $405 In One Month

I cleared up $405 in one month recently. Not so bad—is it—for a fellow who just completed your course a short time ago. I sure have been coining the dough. I never will regret the money I paid for your course.
Emmet Welch,
Peculiar, Mo.

### From $15 to $80 a Week

Before I enrolled with you I was making $15 a week on a farm. Now, I earn from $2,080 to $4,420 a year and the work is a hundred times easier than before. Since graduating a little over a year ago, I have earned almost $4,000 and I believe the course will be worth at least $100,000 to me.
(Signed) George A. Adams,
Route 1, Box 10,
Tamaqua, Pa.

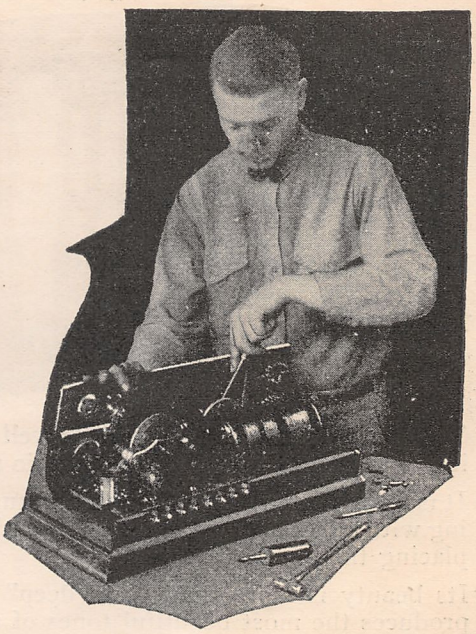
### Triples Salary

I am earning three times as much as before enrolling and I have clean interesting work that takes me to all parts of the globe. I tell you, boys, it's Radio for me.
Arthur Herke,
Vancouver, B. C.

### Earns College Education

I entered the maritime service of the Radio Corporation of America and served several months on board ship. I not only had the advantages of visiting foreign countries at no cost to me but I was also able to save enough money to pay for my tuition to college.
G. E. Rogers,
Troy, N. Y.

**The big radio firms are coming to us for their men—they call on us first because they know that our graduates are one hundred per cent. trained experts—they are Recognized Radio Experts.**



## Earn Big Money While Learning

No matter if you know nothing at all about radio or electricity, you can easily and quickly become an expert. Age is no drawback. Our method of teaching makes it fascinating and interesting to learn the mysteries of this new science. Instruments for practical training given FREE with this course are shown at the bottom of this page.

Scores of our students earn big money during their spare time after finishing the first few lessons. Mathew Waldron made $150 in one month—Fred W. Sullivan, of Fall River, Mass., made $84.60 in three weeks. Many students more than pay for their course in this way—while they are studying.

## Satisfaction is Guaranteed

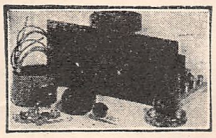
Our faith in our method of training and in our ability to fit you for a bigger pay is evidenced by our guarantee to refund every cent of your money if you are not satisfied when you finish the course. The National Radio Institute, established in 1914, the first school to successfully teach Radio by mail, and now the largest radio training organization in the world, stands behind that guarantee.

## Send for FREE BOOK

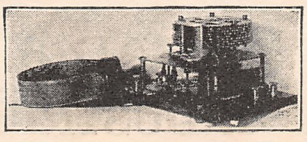
We will gladly send you Free, without any obligation on your part, our book, "Rich Reward in Radio," which gives you more facts about the big pay opportunities in Radio, tells you how we prepare you at home in spare time, and about how we are asked to fill hundreds of fine positions every year. No matter what you are doing now—no matter what your plans for the future are—send for this Free Book of wonderful opportunities. Mail the coupon NOW.

NATIONAL RADIO INSTITUTE
Dept. 13DB Washington, D. C.

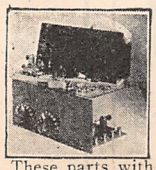
## *for practical training at home*



These parts with instructions are given for experience and practical training in making and operating regenerative receiving apparatus.



This is the world-famous Natromeeter—one of the three instruments given for scientific and practical home training in mastering the code.



These parts with complete instructions are given for practice in building a receiving set of the more simple kind.

National Radio Institute,
Dept. 13DB
Washington, D. C.

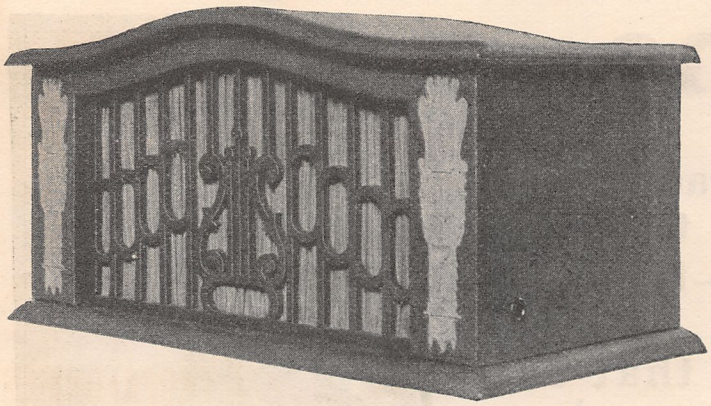
Without any obligation on my part, send me your book, "Rich Rewards in Radio," which tells all about the big-money opportunities in Radio, how spare time study will qualify me as a recognized Radio Expert and also how your Employment Service will help me get a good position.

Name ..... Age.....

Street .....

City ..... State .....

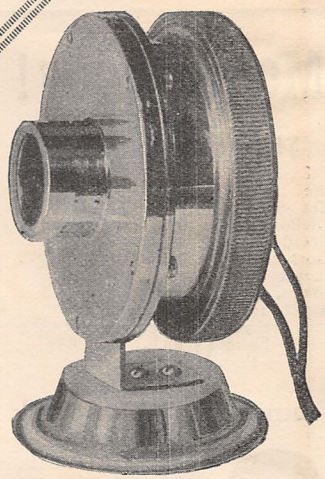
# MELOTONE LOUD SPEAKER



## Aristocrat Model

**$35.00**

**Fully Adjustable**



**$10.00**

## MELOTONE Phonograph Attachment

This newest "RICO" product is well worthy of a place in the splendid "RICO" line of Radio accessories.

It is a truly beautiful article of furniture, harmonizing with almost any scheme of decoration, and replacing the unsightly horn.

Its beauty is more than "skin deep" for it produces the most beautiful tones of any speaker on the market—and we make this statement advisedly.

The voice of the singer, the tone of the instrument come forth from the MELOTONE in your home, exactly as they are delivered into the microphone at the broadcasting station—nothing lost, no distortion no rattling. Try a MELOTONE—have your dealer demonstrate it alongside any other speaker at any price—we'll be glad to abide by your verdict.

At last, a perfect unit!

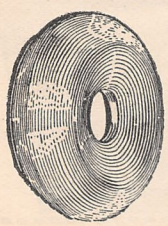
There has, since the beginning of broadcast reception, been a demand for an attachment that would make a **real** loud speaker out of a phonograph—a unit that would reproduce signals clearly, without distortion and in good volume.

There have been a number of devices on the market, none of which came up to the test.

Realizing this, we have for many months, kept our experimental laboratories busy with this problem. We were not willing to market a unit until we produced one that would fill every requirement.

The MELOTONE Unit is the result—we have succeeded in producing the perfect tone. No loud speaker on the market today is its equal—except our MELOTONE ARISTOCRAT, illustrated on this page which contains the same unit.

Get one today, attach it to your talking machine—you'll marvel at the results.



**SPONGE RUBBER**

**"RICO" Fonekushions**

**Patented November 4, 1924**

Made of soft, velvety sponge rubber, they fit any phones, and make listening in on a headset a genuine delight. Be sure to get the original—look for the name "Rico."

**50c a pair**

The Sunday World

NEW YORK, FRIDAY, DECEMBER 6, 1924

**"RADIO RASH" NEWEST PERIL; RUBBER EAR MUFFS TO RESCUE**

BERLIN, Dec. 5.

"Radio rash" is Europe's newest affliction. It is an eruption of the tender skin of the ears of wireless devotees, resulting from the constant pressure of the hard rubber headpieces.

Dr. Marcus of Vienna, writing on the subject for the Clinical Review, says the rash, while very annoying, is not serious when attended to promptly. "Use of soft rubber "ear muffs," which fit over the hard ear pieces, is suggested as a precautionary measure.

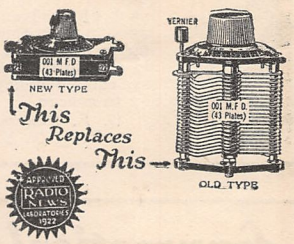
**There is only one soft rubber "ear muff" namely RICO**

## "RICO" Straight Line Condenser

This wonderful condenser is gaining favor daily, as evidenced by the continually increasing demand.

It requires two-thirds less space than the mesh type, is exceptionally low loss and has the added advantage of being dust-proof. Adaptable for any circuit .00025, .0005 or .001 mfd. complete with dial .....$1.75

Without dial .....$1.50

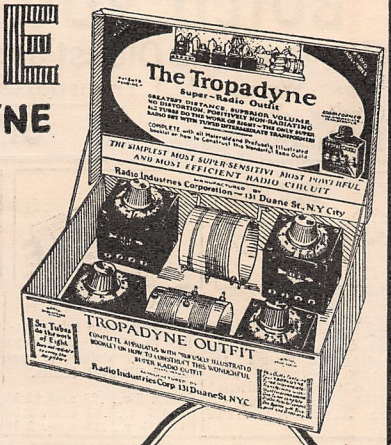



**RADIO INDUSTRIES CORPORATION**

**133 Duane Street New York City**

# $28.75 TROPADYNE

## SUPERIOR TO SUPER-HETERODYNE




The TROPADYNE CIRCUIT is superior to super-heterodyne. In the TROPADYNE six tubes do the work of eight! And the TROPADYNE brings in all the stations on an indoor loop.

The TROPADYNE is powerful, sensitive—it is the circuit you will build if you are really determined to save money and get better results.

The complete TROPADYNE KIT contains the necessary parts with complete set of instructions and illustrations. It costs only $28.75 Have your dealer show it to you to-day!

## TROPAFORMERS

The TROPAFORMER is the heart of the famous TROPADYNE circuit.

TROPAFORMERS are the best long wave for super-heterodyne transformers because they can be TUNED.

A RICO straight line condenser is built into every TROPAFORMER. It is this feature which makes individual tuning possible.

When TROPAFORMERS are first installed they are TUNED to be matched. They need not be touched again thereafter, as the balance is permanent. The improvement in results will surprise you. Distances you have never been able to get will come in easily.

Your dealer also sells TROPAFORMERS separately.

**$6.75**

## RICOFONES

**Finest Phones Made**

**$2.95**

No matter how good your set, your reception is made or marred by the phones you use.

Rico Phones are noted for their clear musical tone—they give good results with any type set, from the modest crystal to the big multiple tube receiver.

Rico Phones will give as good reception as any phone on the market.

**WHY PAY MORE?**

## "RICO" No. 6 Head Set

Enormous quantity production, made necessary by the overwhelming demand for RICOFONES, has made possible this low price.

RICOFONES are guaranteed exactly matched in tone, every pair tested by experts. They contain the famous Rico patented features and reproduce all signals without rattle or distortion.

RICO PHONES ARE GUARANTEED ABSOLUTELY FOR ONE YEAR.

**If Your Dealer Cannot Supply Any of These Products, Order from Us—Using Coupon**

RADIO INDUSTRIES CORPORATION

133 Duane Street New York City

Radio Industries Corp., BN2
133 Duane Street, N. Y. City.

Gentlemen:

As my dealer cannot supply me, kindly ship me the following material for which I will pay postman on delivery.

.....

Name .....

Address ..... City ..... State.....

# "BUILD YOUR OWN" WITH "RASCO" PARTS!

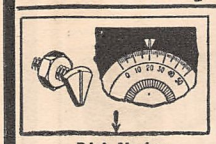
## Buy from the Oldest and Original Exclusive Radio Parts House in the United States

We pay ALL transportation charges in U. S. ALL GOODS SENT PREPAID IN 24 HOURS

Order direct from this page.

**SPECIAL PRICES FOR THIS MONTH**

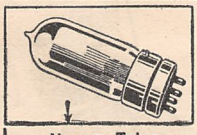
Money refunded if goods do not satisfy



**Dial Marker**

The big little thing you have been waiting for. Just drill a hole in the panel and mount the marker above the dial. Nickel plated and polished.

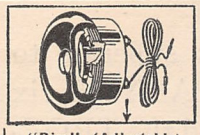
F7788 Dial Marker, each .....$.05



**Vacuum Tubes**

Only best make tubes carried in stock. Any tube replaced if defective, providing filament lights.

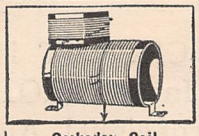
F201A 5 v., .25 amp. $2.50
F199 3 v., .06 amp. 2.50
F12 1½ v., .25 amp. 2.50



**"Rico" (Adjustable) Loud-Speaker Phone**

Has rubber gasket underneath diaphragm, making phone fully adjustable. Gives amazing results as loud-talker on 1 and 2 stages of amplification.

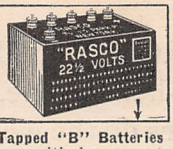
F2525 Speaker with 5 ft. cord .....$2.65



**Cockaday Coil**

Guaranteed best make. Three windings of No. 18 Magnet wire. Has brass brackets for panel or base mounting. Satisfaction guaranteed or money back.

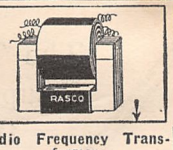
F2750 Cockaday coil $1.50




**Tapped "B" Batteries**

We positively guarantee these batteries to be of long life. We carry only fresh stocks. All with taps.

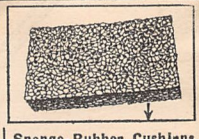
F2250 Sm. 22½ v....$.85
F2251 Medium Navy size, 22½ volt.....1.20
F4500 Medium size, 45 volt .....2.30




**Audio Frequency Transformer**

No better Transformer made. Highest class materials. Impregnated coils. Silicon steel stampings used. Save 50 per cent by assembling it yourself.

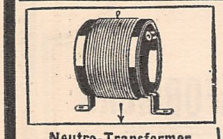
F1100 Ratio 4½-1..$2.00
F1150 Ratio 6½-1... 2.00



**Sponge-Rubber Cushions**

Get rid of tube noises due to vibration. Softest sponge rubber made. Size 2½"x3", ⅜" thick.

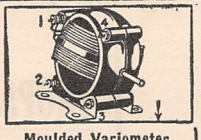
F8989 Sponge-rubber cushions, each .....$.12
Six for .....$.60



**Neutro-Transformer**

Can be used for all tuned radio frequency circuits. Made for usual broadcast waves. Secondary has one center tap. Two genuine bakelite tubes. Silk wire. Furnished with 2 brackets.

F1159 Transformer, er .....$1.65



**Moulded Variometer**

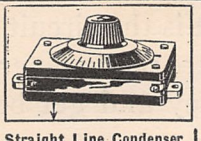
Highly substantial instrument. Silk windings. ¼" shaft. Bottom flange when placed into 4, 3 direction makes instrument panel mounting. 180 to 650 meters. Money back if this instrument is not all that we claim for it.

F5350 Variometer ..$3.00

**FONEKUSHIONS**

Made of sponge rubber. Make wearing your receivers a pleasure. Positively exclude all noises and make reception a pleasure. Sponge rubber will last for years. Light as a feather.

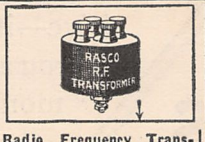
F3550 Fonekushions, set of two .....$.42



**Straight Line Condenser**

Simplest and most practical type of condenser.

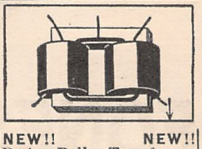
F4430 "Rico" Condenser .001 mfd. 43 plate capacity .....$1.75
F4110 .00025 mfd. 11 plate capacity .....$1.75
All types no dials $1.50




**Radio Frequency Transformers**

Best Radio Frequency Transformer developed so far. Designed by R. E. Lacault, Associate Editor RADIO NEWS. Air core type. 200-600 meters.

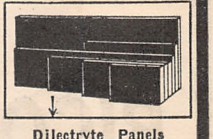
F2800 Transformer, size 1¾"x2½" .....$1.50



**NEW!! NEW!!**

Push Pull Transformer for many new circuits. See any radio magazine. Made of best materials. Coils impregnated. Silicon steel laminations. Save 50 per cent by assembling yourself. Simple instructions furnished.

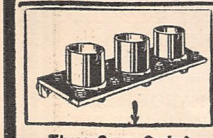
F1159 Push-Pull Transformer, ratio 6½ to 1 $4.00



**Dilectryte Panels**

Highest dielectric strength as per Bureau of Standards. Beautiful high finish.

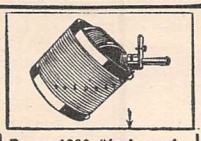
F7100 7x10x3-16"...$.70
F7120 7x12x3-16"... .85
F7140 7x14x3-16"... .95
F7180 7x18x3-16"...1.25
F7210 7x21x3-16"...1.45
F7240 7x24x3-16"...1.65



**Three-Gang Socket**

Aluminum shells, genuine heavy bakelite base, 3 brackets for mounting, 12 nickel binding posts. Length 7¼".

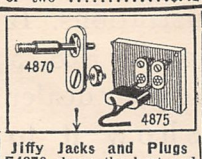
F5995 3 gang socket $1.50



**Rasco 180° Variocoupler**

Silk wire wound on bakelite tubes. Six taps. Wave length, 150 to 600 meters. For panel mounting. ¼" shaft. Your money refunded if it is not all we claim.

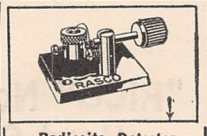
F3100 Variocoupler prepaid .....$1.50




**Jiffy Jacks and Plugs**

F4870 shows the best and cheapest cord tip. Mounted behind panel. Positive contact. F4875 shows new Jiffy Cord Plug and two Jiffy Jacks. F4870 Jiffy Jack nut and screw, ea...$0.05
F4875 Two Jiffy Jacks and One Jiffy Cord Plug .20

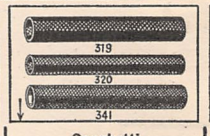
**BE SURE TO SEE PAGE 1471 OF "RADIO NEWS" FOR NEW "RASCO" GOODS**




**Radiocite Detector**

Base solid black composition. Automatic crystal holder. Triple adjustments. Smallest, neatest detector made. Radiocite crystal. 200,000 in use.

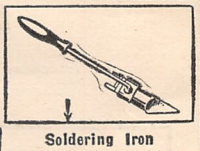
F1899 Detector ....$0.60
F1898 Galena detector .....$.50




**Spaghetti**

Varnished flexible cambric tubing, 319 takes No. 22 wire; 320 takes 18 to 20 wire; 321 takes 16 to 18 wire; 341 takes 22 to 28 wire.

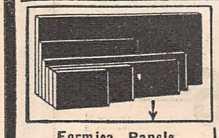
F319-320-321 Per ft.$.06
F341 Flexible soft rubber tubing; 10 feet for..$.20



**Soldering Iron**

Smallest and handiest made. Fits any flat iron or percolator plug. Plug then becomes handle. 5" long. Complete but without plug or wire.

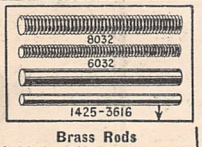
F2200 Soldering iron .....$1.45



**Formica Panels Clearance Sale**

As we are discontinuing these particular sizes, this material is now offered at cost. All 3-16" thick.

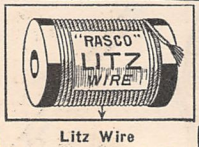
F352 9x12" each...$1.75
F354 6½x19½" ea. 1.90
F356 6x14" each.... 1.60
F357 6x4" each..... .65




**Brass Rods**

Sold in 6" lengths only.

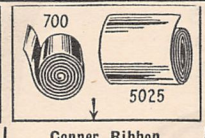
F8032 Rod, 8-32" thread length .....$.08
F6032 Rod, 6-32" thread length .....$.06
F1425 Rod, plain ¼" round, length .....$.10
F3616 Rod, plain 3-16" round, length .....$.06




**Litz Wire**

Prices are per foot. E= equals.

F823 E No. 25 B&S $.02
F890 E No. 28 B&S .01
F891 E No. 21 B&S .03
F892 E No. 20 B&S .04
10 per cent discount in 100 foot lots.




**Copper Ribbon**

.005" thick.

F700 ⅜" wide; F701 ¼" wide; F702 3-16" wide. All sizes per foot...$.01

**Copper Foil**

.001" thick. 4" wide.

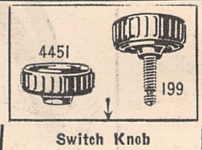
F5025 Copper Foil, per foot .....$.10
10-foot length ..... .80

**Tin Foil**

All our tin foils come 4" wide. Uniform product throughout.

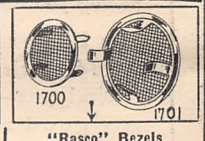
Best grade only J850 has 1500 sq. inches per lb.

F851 700 sq. inches to lb.
F850 Tin foil.....lb. $.48
F851 Tin foil ....lb. .48




**Switch Knob**

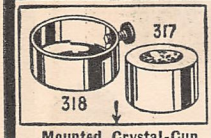
F199 Knob, 1⅛" dia., height ⅝"; 8-32" screw.
F4451 Has 8-32" or 10-32" bushing, no screw.
F199 Knob .....$.10
F4451 Knob ..... .06




**"Rasco" Bezels**

Finest Bezel on the market. Bezel comes entirely nickel plated. Can be used on ⅛ or 3-16" panel.

F1700 Rasco Bezel, 1 inch .....$.15
F1701 Bezel, 1½" diam. ..... .20




**Mounted Crystal-Cup**

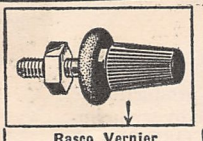
Cup has screw and adjustment nut. Fits all standard mounted crystals. Nickel plated, polished.

F318 Nickel Cup ....$.20

**Radiocite**

Best most sensitive mounted crystal. U. S. Navy using it. Each tested.

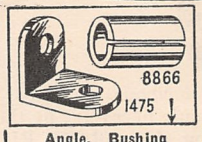
F317 Radiocite Crystal .....$.25



**Rasco Vernier**

Why use a vernier condenser when a vernier attachment will do anything and everything a vernier condenser accomplishes? Cleverest vernier made. Can be used with any dial. Soft rubber ring engages dial. Nothing to come apart.

F1450 Vernier .....$.18




**Angle Bushing**

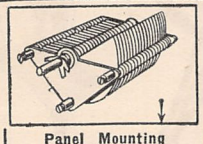
Angle piece used to mount panels, etc. 1,000 uses. 5-16" wide, height 7-16".

F1475 Angle piece, Each .....$.03

**Adapter Bushing**

Makes ¼" dial fit 3-16" shaft. ½" long.

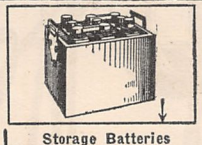
F8866 Bushing .....$.01



**Panel Mounting Low Loss Condensers**

Positively no better condenser on the market. Shafts ¼". Save from 40 to 60 percent by assembling condenser yourself.

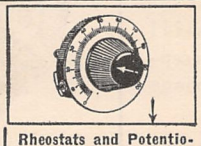
F1111 11 Plate....$1.10
F2121 21 Plate.... 1.22
F4343 43 Plate.... 1.33



**Storage Batteries**

Guaranteed for two years. Only NEW material used. Acid proof terminals. Patent vents.

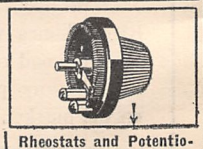
F2400 Two volt, 40 amp. hours .....$3.90
F640 Six volt, 40 amp. hours ..... 7.25
F666 Six volt, 60 amp. hours ..... 9.50
Shipped express collect.



**Rheostats and Potentiometers**

Come with metal dials and composition knob. Excellent merchandise despite low price.

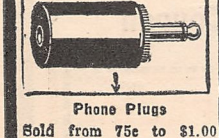
F4210 6 ohm Rheo.$.27
F4211 30 ohm Rheo. .30
F4212 200 ohm Potentiometer ..... .45



**Rheostats and Potentiometers**

High heat dielectric base. Come with tapered, knurled knob, 2½" dia. Complete with pointer.

F4310 6 ohm .....$.38
F4311 30 ohm ..... .44
F4312 Potentiometer, 200 ohms ..... .65



**Phone Plugs**

Sold from 75c to $1.00 everywhere. Hard rubber composition shell and patented cord tip holder. Finest workmanship throughout.

F1030 Rasco Telephone Plug. Each .....$.35

**Bakelite Socket**

Octagon shape. Four nickel binding posts, phosphor bronze contact springs. Best brown bakelite.

F6510 Bakelite socket $.40
F6500 Tube Socket. Made entirely of composition. Best made. Each ....$.35

**Condensers**

Best made, paper-impregnated condensers. Capacity guaranteed.

F5050 Phone Condenser, .001 .....$.20
F5056 Grid Condenser, .00025 .....$.20
F5059 Grid Leak Condenser, .00025.....$.30

**Name Plates**

All name plates brass with silver letters.

F8389 (Right or left) $.10
F809 Comes in 35 styles. Any denomination, each style .....$.04
Panel Scale. 2½". 90°. metal, silver background, black lettering.
F715 Scale. Each....$.15

**Binding Post Name Plates**

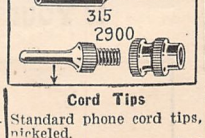
Dia. ¾". These styles: Phones, Ground, —, Output, "A" Bat. —, "B" Bat. —, Loud Speaker, "C" Bat. —, Aerial, + Input, "A" Bat. +, "B" Bat. +, Loop "C" Bat. + New! "A" Bat. + "B" Bat. —.

F6000 Name Plates, all styles, each .....$.03

**"Rasco" Posts**

Made of black composition.

F650-51 Each .....$.08
F202 Has nickel-plated bottom, each .....$.08
Dozen, each style....$.90
F122 Initialed Binding Posts. Six popular styles. Each .....$.06




**Cord Tips**

Standard phone cord tips, nickeled.

F315 Each .....$.03

**Separable Cord Tips**

No solder required. Wire goes in ferrule. Shank holds it tight. Nickel plated.

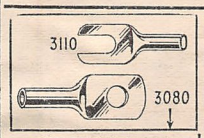
F2900 Each .....$.06

# RADIO SPECIALTY COMPANY, 98 Park Place, New York City

Factories: Brooklyn, N, Y. Elkridge, Md.

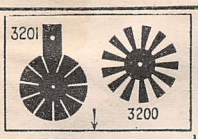
# "BUILD YOUR OWN" WITH "RASCO" PARTS!

## Lowest Prices in America



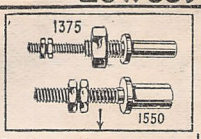

**"Perfect" Lugs**

These new and improved lugs are brass, nickel plated, flattened on top as shown. Made of a single piece of metal. Lead wire goes into tube. **F3110, F3080** "Perfect" Lugs. Each .....$0.02
Dozen lots ..... .20

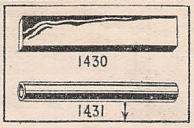



**Spider Web Forms**

Fine forms to wind your spider webs. Made from hard, well seasoned fibre, 1-16" thick, center and side holes for wiring. Both 5" diameter.
**F3200** Spider form...$.25
**F3201** Spider form... .25




**F1375** Universal Bearing to hold rotors. Length of bearing 2¾", shaft 1¼" thread 1" long threaded sleeve ¾" long, each .....$.25
**F1550** Sockettes. Four of these take one vacuum tube. Grasp tube firmly. Best by test. Set of 4 $.25

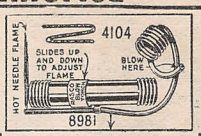



**Brass Strip and Tubing**

Brass strip ½" wide; 1-16" thick; 6" long.
**F1430** Per length....$.10
**F1431** Brass tubing, dia. ¼"; 6" long; length $.15

**Threaded Brass Rods**

Sold in 6" lengths only.
**F8032** 8-32" thread $.08
**F6032** 6-32" thread .06

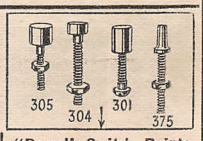



**Alcohol Blow Torches**

Best made. Give intense hot flame. Great for fine work.
**F8981** 5" Torch.....$.85
**F8982** 3" Torch..... .50
**F4104** Rosin Core Solder. A non-corrosive solder with flux inside.
18" length .....$.10

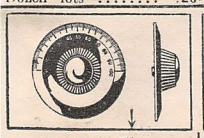
**Tropaformer**

The only scientific intermediate Super-Heterodyne transformer. It combines transformer and condenser and enables the transformer to be tuned to the finest degree. 3" dial included in price. **F3510** Tropaformer, each .....$6.75




**"Rasco" Switch Points**

Nickeled and polished.
**F301** ¼"x¼", 6-32", doz. .....$.18
**F304** ¼" dia., ½" thick, 6-32", doz.... .18
**F305** ¼" dia., 3-16" thick, 4-36", doz.... .18
**F375** Switch stop ⅞" long, with nut, doz... .18

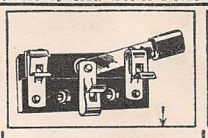


**Moulded Dials**

Only very best grades handled. Bushings absolutely true. Dials cannot wobble. Letters inlaid in fast white enamel. All dials for ¼" shaft.
**F3074** Dial 2" .....$.20
**F3075** Dial 3" ..... .25
**F3076** Dial 4" ..... .40

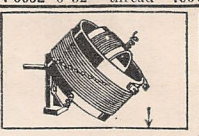
**Tuned Radio Freq. Kit**

Build your own Neutrodyne or Neutro-Reflex with this kit. Contains 3 R.F. Neutro-Transformers with .0005 condenser attached; two Neutralizing Condensers. Also illus. book.
**F8778** Radio Frequency Kit .....$13.85



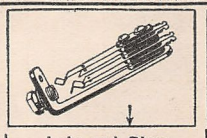
**Throw Switches**

Mounted on composition block. Small enough for all radio purposes.
**F4100** Single pole...$.25
**F4101** Double Throw Single Pole .....$.35



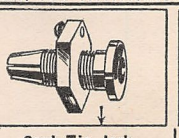
**Bakelite 180° Coupler De Luxe Style**

Tubes of natural color bakelite, wound with green silk. Cast aluminum bracket, ¼" shaft. Primary 13 taps. 180 to 550 meters.
**F3150** Coupler .....$2.35



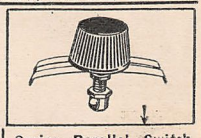
**Jacks and Plugs**

Best materials. Silver contacts. Factory-making Postal Telegraph jacks, makes these.
**F1000** Jack 4 springs $.65
**F1001** Jack 3 springs .75
**F1002** Jack 5 springs .80
**F1003** Plug ..... .35



**Cord Tip Jack**

Takes place of binding posts. Cord tip firmly gripped by jack. Made of brass, nickel plated. Screw to attach lead wire. No soldering necessary.
**F1500** Cord tip jack. Each .....$.15

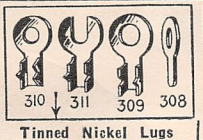


**Series Parallel Switch**

Quick change from one circuit to another. Black composition knob, nickel plated fittings. Blade radius 1¼".
**F2950** Series parallel switch .....$.25

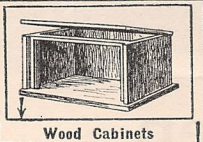
**Melotone Loud Speaker**

Best popular loud speaker. Fibre horn, heavy metal base, five ft. cord. Nickel gooseneck. Greatest tuned (adjustable) talker. Horn length 11½"; bell 6⅝"; total height 9".
**F255** Melotone Speaker .....$4.00




**Tinned Nickel Lugs**

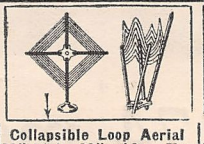
All our lugs are tinned.
**F310** Brass Lugs for No. 8 screw, doz. .....$.10
**F311** Copper Lugs for Nos. 6 and 8 screws, doz..$.10
**F309** Copper lugs for Nos. 4, 6 and 8 screws, doz .10
**F308** Copper Lug for 6-32 screw, doz. ..... .10



**Wood Cabinets**

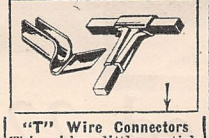
Highest grade mahogany cabinets made. Top is hinged. Made of ⅛" stock.

| | | |
|---|---|---|
| **F710** | Panel, 7x10" | $2.60 |
| **F712** | Panel, 7x12" | 3.00 |
| **F714** | Panel, 7x14" | 3.15 |
| **F718** | Panel, 7x18" | 3.40 |
| **F721** | Panel, 7x21" | 3.75 |
| **F724** | Panel, 7x24" | 4.20 |



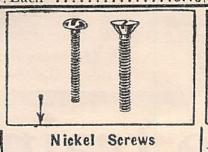
**Collapsible Loop Aerial**

32" high, 28" wide. Has heavy cast base upon which loop turns easily. Winding consists of special multiple stranded wire. Loop readily folds to fit into 4" tube. Hard rubber insulation. **F2610** Collapsible loop .....$3.75



**"T" Wire Connectors**

This big little article solves all troubles when making "T" wire connections. Made to take 1/16" square or round bus-bar wire. Can be attached with a pair of pliers.
**F2975** "T" Wire Connectors, 12 for....$0.05



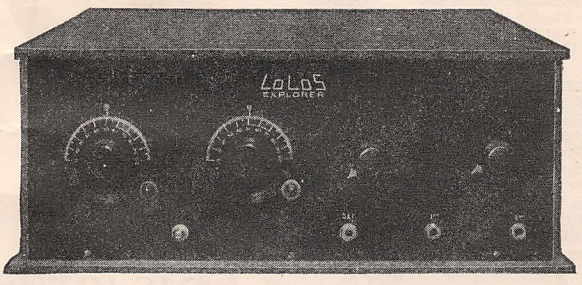
**Nickel Screws**

Made of brass, nickel plated. Flat and round head style. Any thread up to 10/32".
Price, ¼", ⅜", ½" long, dozen .....$.15
Price, sizes ¾" and 1" long, dozen .....$.30

**Duo-Spider Coil**

For Reinartz circuit, 200-600 meters. 19 taps. Size 4¼" diam.; 1⅞" center opening. Coil is firm and will not fall apart.
**F2650** Spider Coil $1.15
**F2660** Coil for panel mounting. 225-600 meters .....$1.90

# THE "LOLOS EXPLORER"




HERE is a 3-tube set that is positively a "knock-out." It is of the latest low loss type throughout. It contains a low loss 3-circuit tuner, a low loss Condenser, low loss Sockets, etc., and will bring in stations a thousand miles away on the loud speaker. See list of stations logged inside of two hours. **This is not a newfangled new set,** no latest revolution, no "wonderdyne" no extravagant freak circuit. Instead, it is a good, old-fashioned 3-circuit set, **but it reduces all the previous known losses to practically zero.**

Its great secret lies in the fact that practically all losses are done away with and that the greater part of energy heretofore wasted in similar sets **is conserved**—hence the astonishing results possible with this set.

By means of the low loss 3 circuit Tuner and the low loss Condenser the set has razor sharp selectivity; that is why we furnish verniers, and even these must be handled carefully as distant stations can be brought in or lost by a 1/64-inch motion of one of the dials.

The great outstanding merit about this set is that it will cut right through locals and bring in distant stations. Moreover, as the chart shows, **you can log stations** and as there are only two dials you can always tune in stations at exactly the same points, once you have brought them in.

At the price advertised, the set comes to you with all parts, even the screws, complete to assemble, which can be done within two hours. There is nothing missing—mahogany cabinet, a drilled panel, and baseboard are all included. All you have to get is three tubes, and "A" and "B" Batteries, which are not included in the price. We have never tested an outfit more suitable for long distance broadcast reception, and we guarantee the **"LoLos Explorer"** in every respect. Your money refunded if this set is not entirely satisfactory to you in all respects. Works equally well on 201A or dry battery tubes.

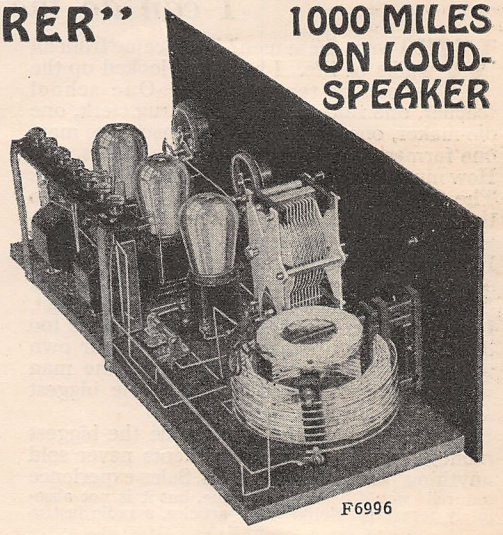
**IMPORTANT—No technical knowledge required to build this set. Directions are so explicit, so simple, so clear that a 12 year old boy can readily put our set together.**

### STATIONS LOGGED ON "LOLOS EXPLORER" in 2 hours at New York City

| Station | Dial Settings | | Location |
|---|---|---|---|
| WJZ | 72 | 65 | N. Y. City |
| WEAF | 86 | 77 | N. Y. City |
| WFBH | 65 | 21 | N. Y. City |
| WFAM | 55 | 18 | St. Cloud, Minn. |
| WQAO | 73 | 40 | N. Y. City |
| WEBH | 75 | 43 | Chicago, Ill. |
| WJY | 72 | 52 | N. Y. City |
| KDKA | 70 | 32 | Pittsburgh, Pa. |
| WTAS | 67 | 25 | Elgin, Ill. |
| WGBS | 67 | 30 | N. Y. City |
| WHN | 72 | 39 | N. Y. City |
| WJAX | 88 | 48 | Cleveland, Ohio |
| WIT | 75 | 83 | Philadelphia, Pa. |
| KYW | 78 | 93 | Chicago, Ill. |
| WOC | 83 | 74 | Davenport, Iowa |

ALL ON LOUD SPEAKER

## 1000 MILES ON LOUD-SPEAKER

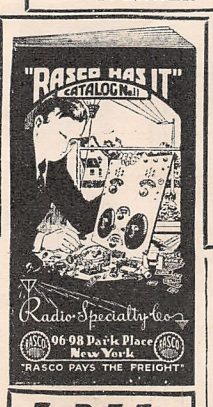


F6996

## List of Parts

1 "Gen-Win" Low Loss Coupler; 1 7x18 Mahogany Cabinet; 1 7x18 Panel already drilled; 1 Baseboard; 2 "Calibrated Somerset" Audio Frequency Transformers; 1 "Certified" Low Loss Condenser; 2 Rheostats; 3 Bakelite Sockets; 2 3" Dials; 3 Jacks; 7 Binding Posts; 1 Grid Leak and Mounting; 1 .00025 Condenser; 2 Dial Markers; 2 RASCO Verniers; 2 Angle Plates; 10 ft. Bus Bar; 1 Switch; 1 Bakelite Binding Post Strip; 7 Binding Post Name Plates; 24 Screws; 1 Set of Directions. Total Price of Goods .....$33.71

OUR PRICE .....**30.25**




**FREE.**
**A POSTAL BRINGS IT**

## New 1925 "Rasco" Catalog No. 12

**CONTAINS 75 VACUUM TUBE HOOK-UPS, 300 ILLUSTRATIONS, 500 ARTICLES, NOW 98 PAGES**

All Armstrong Circuits: These important circuits are explained clearly, all values having been given, leaving out nothing that could puzzle you.

Just to name a few of the Vacuum Tube circuits: The V.T. as a detector and one-step amplifier; all Armstrong circuits; one-step radio frequency amplifier and detector; three stage audio frequency amplifier; short wave regenerative circuits; 4-stage radio frequency amplifiers; radio and audio frequency amplifier; inductively coupled amplifier; all Reflex Circuits.

## Wanted

**This Company is always in the market for new ideas. Any small specialties in demand by the radio fan will be highly welcomed by us. Some of the articles shown on these pages originated with our customers, whom we paid well for the ideas. Send your sketch or model addressed to Research Department, c/o this Company.**

F6060

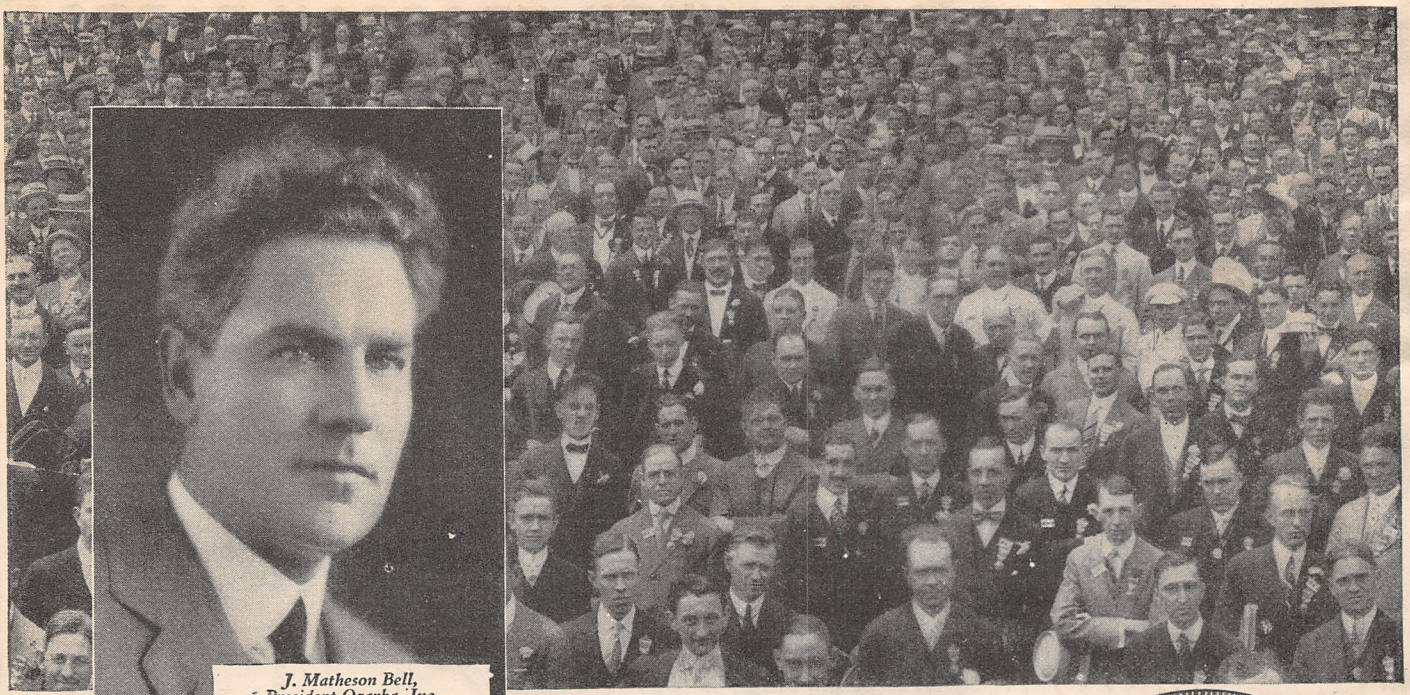
## SPECIAL

Genuine RICO 2000 ohm double head set. Standard phone with 6-foot cord. Tripole type. Regular price, $4.00. Our special price. F6060.

**$2.50**

Money back if not satisfactory.

**RADIO SPECIALTY COMPANY. 98 PARK PLACE, NEW YORK CITY**



J. Matheson Bell,
President Ozarka, Inc.

# I have trained 2274 men to make big money in Radio

## *I can do the same for you*

WHO were these men? They came from all walks of life. I have just looked up the record of ten of them. One school teacher, one railroad man, one drug clerk, one die-maker, one electrician, one insurance man, one farmer's son, one travelling salesman.

How much are they making? $50 to $500 a week. The $50 men are mostly those who give me their spare time. A great many of my representatives start that way.

How much did they know about radio at the start? Very little, in many cases nothing. Lack of radio knowledge is not a handicap. In fact, I rather prefer the man who hasn't delved too deeply into radio theory. We have our own methods—they are successful—and the man with nothing to unlearn makes the biggest success of our plan.

Many of the men who have made the biggest money selling Ozarka instruments never sold anything before in their lives. Sales experience naturally would be of some value, but it is not absolutely necessary. Unlike other articles, a radio instrument does its own talking. Your demonstrations are given during the evenings, which is possibly your spare time. In the hands of the man who knows the instrument it will deliver its best, and you can safely put it in competition with any instrument on the market today, regardless of its price.

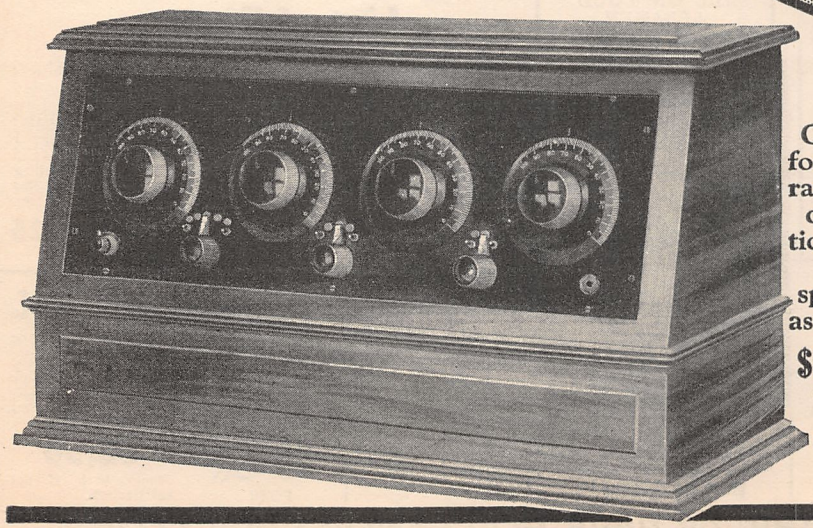
The man I want is known in his community as upright and reliable—a man whose word is as good as his bond—a man who has lived in his community long enough so that his fellow men know him and know the real type that he is. He may not have any considerable amount of money, but he has a little; in fact, in many cases the man who is particularly interested in my plan is the one who is having rather a hard time making ends meet. He is, however, the type of man who would not handle anything unless he was thoroughly convinced of its merit. If you are this kind of a man and are really sincere in wanting to improve your financial conditions, I will be very glad to tell you of the Ozarka Plan. I can train you to make considerable more money than you are now making. I have done this with 2274 men in the past two years, and I will do it for you if you will do your part.

*This Button identifies Ozarka Representative in your city—your assurance of complete radio satisfaction*

## This large Book tells how to make $100 per week under Ozarka Plan

The Ozarka Plan is fully described in a large illustrated book. I will send a copy to men who are willing to tell me fully about themselves. The Ozarka book is a true story of life, of men, of why they fail, and how they succeed. It tells how men are carving out futures for themselves in this fascinating business of radio.

In territory not now covered, I want the right man. If you feel qualified and are willing to put forth the necessary effort to obtain a splendid, profitable business of your own, write me and say "Send your Ozarka Plan Book No. 100." It may be the turning point in your life. Don't fail to mention the name of your county.



Ozarka four tube radio for operation with loud speaker as low as **$39.50**

## OZARKA, INC.

804 Washington Blvd., Chicago

RADIO NEWS

H. GERNSBACK, Editor and Publisher
ROBERT E. LACAULT, Associate Editor

EDITORIAL AND GENERAL OFFICES, 53 PARK PLACE, NEW YORK

Vol. 6 FEBRUARY, 1925 No. 8

# Radio Evolution

## By HUGO GERNSBACK

RADIO, like the whole of the universe, shares in the universal evolution. Just as a tree grows from a small seed, Radio has grown from infinitesimal beginnings into a huge art. If someone had the time and money it would be a beautiful thing to assemble a radio museum. A profitable afternoon might be spent in walking through such an interesting collection and looking over the various types of radio apparatus from the days of Hertz down to our latest Super-Heterodyne and present day commercial sending station equipment. It would be an education complete in itself. We would smile, and perhaps laugh, at the original model coherer, or the primal tuning coil, or the first sending and receiving sets. Just so, the imaginary visitor who visited this radio museum twenty-five years from *now* would smile at our present efforts, if he did not laugh out loud.

For such is the way of evolution. A thing a few years old is hopelessly outclassed and looks as silly to us as do the bustle and beaver hat to the present owner of a vanity case or derby. All the while we are bringing out new things, learning new ways about our friends, the radio waves, and are hopeful of learning more of their nature. The writer says "hopeful" because it does not appear that we shall ever know much about them. In the meantime, we are finding out a few things and trying to improve our present crude apparatus and instruments, because crude they still are, and crude they probably will remain for a long time to come. To be sure, our present efforts are not as crude as those of twenty-five years ago, but nevertheless there is much to be improved.

The coming year, for instance, will probably go down in radio history as the Low Loss Year. We have suddenly found out, it would appear, that our former good old condensers and our former aristocratic tuning inductances are all wrong. Soon they will be as extinct as the proverbial dodo. The reason for this is that a few nights spent in our laboratories have shown us that radio frequency currents behave in an outrageous manner as compared to their brothers, audio or low frequency currents. For instance, when we connect a bell to a battery and a push button, and run the wire along the wall, this does very nicely, providing the wire is fairly well insulated. There are practically no losses encountered in such a system.

BUT try to do the same thing with radio frequency currents; that is, the currents that are induced into the aerial by radio waves; immediately many awful and wonderful things happen. We find that if we string even a well-insulated wire against a wall, that wire immediately becomes an excellent sieve, *i.e.*, a great part of the radio frequency currents pass right through the insulation and into the wall, and if the end of the wire happens to be a radio receiving outfit, there isn't much current left to operate the set. We also find that what we formerly thought were excellent insulators act almost as badly as metals when we try to use them in radio instruments.

Thus, for instance, a fine insulator, silk, which was formerly considered excellent for use as wire insulation no longer is considered good at all when used in a radio inductance coil. And so on down the line through many similar reversals of practice. For that reason we now have the present Low Loss era. Instead of using bakelite, cardboard, or hard rubber tubing for our inductances, our engineers prefer to use air—and no tubes at all—because air just now is the best insulator.

During the next year we shall have a fearful outcropping of such coils which will take on the most fantastic shapes. Indeed we are seeing many of them right and left even now. The same is true of variable condensers, which are also, due to the same reasons, taking on the most grotesque forms imaginable. And all in order to cut down not only radio frequency losses, but also to make the minimum capacity of the condensers as small as it is humanly possible to make it. For if the minimum capacity of a condenser is high, it is impossible to tune down to the low wave-lengths.

Our fixed condensers have as yet not been touched by the low loss fever, although they are the worst offenders in this respect. Nearly all fixed condensers, whether mica-insulated or otherwise, have fearful losses in the eyes of the engineer, and it is safe to say that we shall have a revolution in fixed condensers, just as we are having it now in the variable types.

In the vacuum tubes, our leading manufacturers already have helped the movement by providing composition bases which are now incorporated in all of the better vacuum tubes, instead of the former metal bases, which gave rise to capacity effects and losses.

Vacuum tube sockets also have large losses, which probably will soon be remedied.

Then the little, but most important item, our bus bar construction will probably come in for hot discussion during the next few months, for it begins to appear that our bus bar connecting wire causes more losses in receiving sets than all of the other losses combined. It will be found, during the coming year, that only a certain thickness of bus bar will be suitable for best results. It probably will be found also that the shape of the wire must be round. Square wire, the writer believes, will be as popular, at the end of this year, as yellow fever, for it seems that the square edges give rise to losses. And even our beautifully-arranged wiring that we Americans are now so fond of, with all the nice right angle corners, will soon be avoided, for it seems that a right angle on bus bar wire is a thing greatly to be avoided. *All sharp angles create losses.*

Perhaps a wise condenser manufacturer will see these lines and immediately start working on a condenser that has neither sharp points nor sharp edges. If he succeeds, he will have an ideal condenser.

AFTER all these losses have been reduced to almost zero, we shall then have radio receiving sets that will be really efficient, and the writer makes the prediction that we shall soon have ordinary crystal receiving sets made on the low loss principles which will bring in real distance at all times. It would also appear that two and three tube sets will do the work of the present six tube ones. Already we hear enthusiastic reports from investigators who are using low loss receiving sets, and this design is as yet in its infancy. Much can be expected when the losses have been still further reduced.

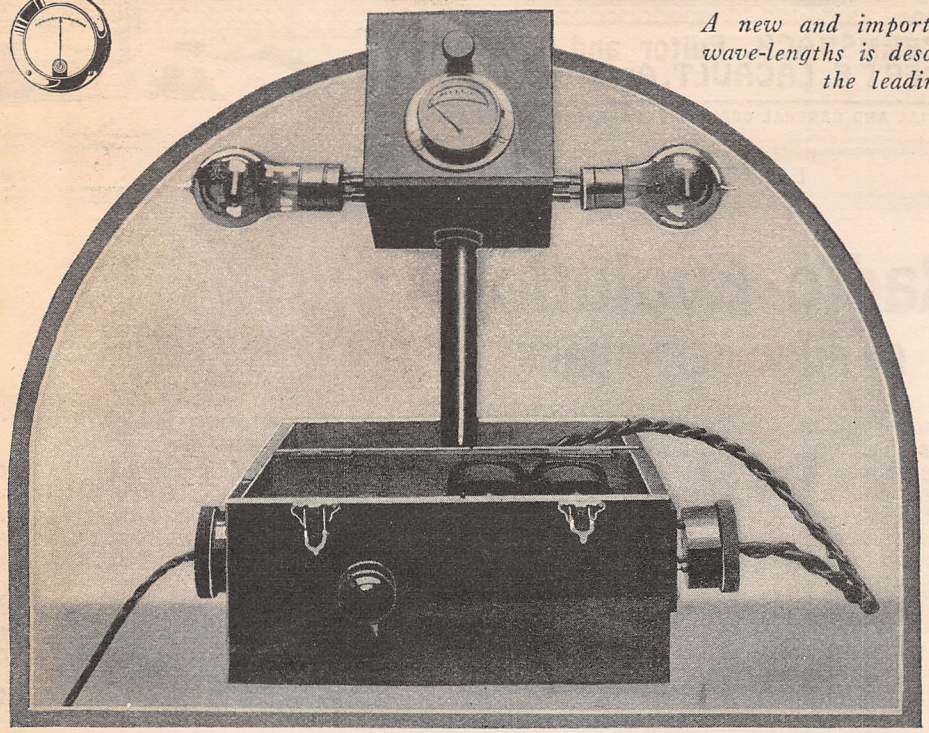
There is really no good reason why, in the future, a 100-watt station should not be received on the loud speaker at the furthest distance possible on this globe, namely, 12,000 miles. It can be proven mathematically that the waves sent out from a small electric buzzer will cover the entire surface of the globe. At a distance of 12,000 miles the waves still persist, although infinitesimally weak. For that reason, if we have, let us say, a 100-watt broadcast station in New York, this station in the future should be picked up by means of a good two or three tube set, providing the losses in the set have all been reduced to the lowest possible minimum, on an antenna 12,000 miles away. And it can be proven mathematically. It is only a matter of the greatest possible sensitivity and then amplification of the minute energy. And this is possible only by stopping all the leaks.

Our present day radio receiving outfits may be compared to a heavily perforated soup ladle. As soon as we start ladling out the soup, it escapes through the perforations. Some of the soup sticks to the sides of the ladle and in the spaces between the perforations. This is our present day radio outfit. Most of the energy leaks away in places that we do not even suspect. Such an innocent thing as a sharp cornered binding post may give us tremendous losses. The future will show.

# Curing Cancer with Ultra Radio Frequencies

## By GEORGE LAKHOVSKY

*A new and important application of very short wave-lengths is described in this article by one of the leading French scientists.*



The two-meter oscillator used by the author in his experiments with the supply box containing the necessary controls and transformers.

SINCE November, 1923, I have published in various technical and radio publications, several papers in which I explained by theory that the instinct or special feeling, which permits birds to direct themselves in space, is only the results of the emission and reception of rays by living beings. While developing this theory, I explained how thoroughly I was convinced that science will discover, some day, not only the nature of microbes by the radiation which they produce, but also a method of killing disease bacilli within the human body by means of the proper radiations.

The researches I have made by means of special apparatus have shown such results, that I believe my theory is correct. This theory is that life is born from radiations, kept going by radiation and suppressed by any accident producing the destruction of the oscillatory equilibrium, especially by the radiations of certain microbes, which suppress those of the weaker cells.

Before going any further in our reasoning, it is necessary, in order to present the facts to the uninitiated reader, to imagine what oscillations really are. The motion of a pendulum will be used for this explanation. When a pendulum is displaced from the position of equilibrium, it moves back and forth producing what are known as ochrone oscillations, until the energy stored is entirely exhausted. By means of a motor, a spring, or an electro-magnet, it is possible to keep the motion of the pendulum of constant amplitude, producing undamped oscillations. If, on the contrary, the source of power is removed, the oscillations die down and it is necessary not only to re-apply the power sustaining the oscillations, but also to furnish additional energy to start the pendulum in motion. This oscillation of a pendulum reproduces exactly what happens in the cells of a living being.

### BODY COMPOSITION

Our organs are composed of cells formed of protoplasm containing various mineral matters and acids, such as iron, chloride, phosphorous, etc. It is by the combination of these elements that the cells detect outside waves and vibrate continuously at a very high frequency, probably higher than the period of X-rays or over all other vibrations known and measured today. The amplitude of cell oscillations must reach a certain value, in order that the organism be strong enough to repulse the destructive vibrations from certain microbes.

**THE new application of short wave-length oscillations described in this article is one of the most important ever found, and we are pleased to present to our readers this article by Mr. George Lakhovsky, the well known French scientist.**

**The experiments described were carried out in collaboration with several doctors and scientists of high standing and it seems from results obtained, that the very high frequency treatments will play an important rôle in the future.**

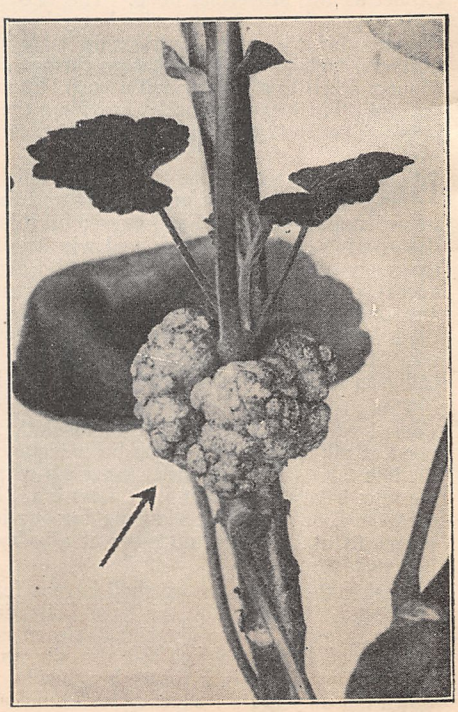
**We shall publish in a later issue another article on this new system, together with the effects of ultra radio frequencies in the treatment of other diseases in human beings.**

The astrophysicians are actually carrying out experiments of great interest on the existence of vibrations, which have been called penetration rays and of which the frequency is higher than that of X-rays and of the alpha, beta and gamma rays of radium. Such rays, according to the theory, are produced by the earth itself and some others come from outside space. Some accurate measurements have proved the correctness of this theory. Therefore, it is quite permissible to believe that these penetration rays, or at least some of them, produce the vibratory motion of living cells and consequently their life.

For instance, let us suppose a cell vibrates at a certain frequency and a microbe vibrates at a different frequency; the microbe begins to fight the cell, and sickness is started. If the cell cannot repel the stronger vibrations and if the amplitude of its own vibration decreases, the microbe gains and its vibrations in decreasing and stopping those of the cells, bring dangerous sickness or death. If, on the contrary, the living cell is started vibrating with the proper amplitude by inside or outside causes, the oscillatory attack is repulsed. Such is my theory. The problem is somewhat similar to the situation in which a rescuer finds himself when, coming to help a friend in a dangerous situation, finds himself fighting hand to hand against strong aggressors. The rescuer does not dare to fire his gun, fearing to harm his friend mixed up with the aggressors in the melee. Similarly, microbes and healthy cells are all exposed to electric or radio-active action, which could be used to destroy the unwanted rays and it is difficult to suppress them without harming or killing at the same time the cells which are to be treated. In fact, since Pasteur, scientists have been constantly searching for means of destroying microbes. The great difficulty with all methods found was that in destroying, the bacillae cell was attacked too. The experience gained in cancer and tuberculosis treated with radium, X-ray, or ultra-violet rays, shows how difficult is the work of the investigators.

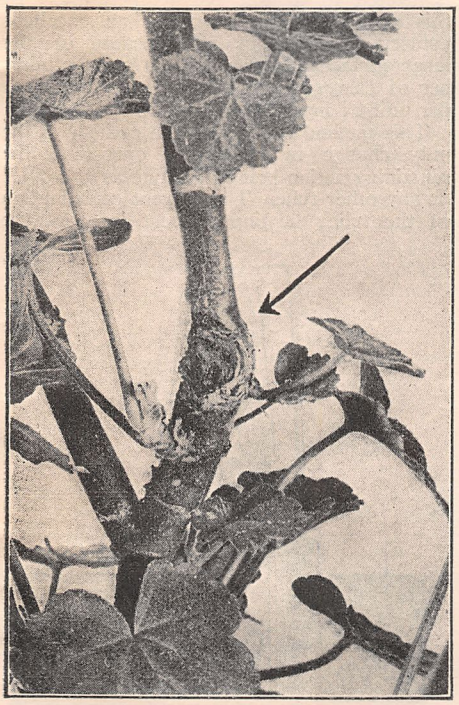
### A NEW METHOD

The remedy in my opinion, is not to kill the microbes in contact with the healthy cells, but to reinforce the oscillations of the cell either directly by reinforcing the radio activity of the blood or in producing on the cells a direct action by means of the proper rays. During January, 1924, I began to build, according to this theory, and with



A plant inoculated with cancer before treatment. The arrow points to the tumor growing on the limb.

the purpose of therapeutic applications, an apparatus, which I have called Radio-Cellulo-Oscillator, with the firm belief that the cells vibrating at extremely short wave-lengths would find their own in the Hertzian waves, which have the properties of producing extremely short harmonics. The cell with very weak vibrations, when placed in the field of multiple radiations, finds its own frequency and starts again to oscillate normally through the phenomenon of resonance. This type of vibration produced by radio waves which I propose to use, is harmless, unlike those of x-rays and radium. Their application, therefore, does not present any danger for the operator.



The plant after treatment. The arrow shows the part of limb where the tumor was.

I exposed in front of my apparatus, during long periods, a certain number of microbes in culture, which developed themselves normally. I, myself, have never felt the effect of these ultra radio frequencies, although I remained for a great many days near the apparatus, during the treatment applied to the living cells. It is only when two living beings such as a cell and a microbe, are in contact, that the rays produced by the Radio-Cellulo-Oscillator have any direct effect upon cellular structure.

The experiments which I carried out at the Salpetriere Hospital in Paris, in the service and with the collaboration of Prof. Gosset, were made with plants innoculated with cancer, and the results were described in a paper presented on July 26, last year, before the Biological Society. The text of this paper follows.

"One knows that it is possible to produce by innoculation of *Bacterium tumefaciéns* in plant tumors similar to those of cancer in animals. One of us obtained experimentally by this method, a great number of tumors. These had various degrees of development. Some of them dry up partially, but do not die entirely until the entire plant or at least the limb bearing the tumor dies. Even removed by surgical methods, these tumors grew again on the sick limb.

### THE RADIO CELLULO-OSCILLATOR

"We propose to describe in this paper, the action of electromagnetic waves of very high frequency obtained by means of the Radio-Cellulo-Oscillator of George Lakhovsky. This apparatus produces wave-lengths of the order of two meters and less, corresponding to 150 million cycles per second. A first plant was submitted to the effect of the radiation one month after being innoculated with cancer; at this time small tumors of the size of a cherry stone were visible upon it. This plant was submitted to the rays twice, for three hours each time. During the following days, the tumors continued to grow rapidly in the same way as those on plants, which had not been submitted to the effect of radiations. However, 16 days after the first treatment, the tumors began to shrink and dry up. A few days later the tumors were entirely dried up and could be very easily detached from the limb of the plant by merely touching them. The drying action of the radio frequency radiations is selective and affects only the sick part of the plant. Even the inside sick tissues were destroyed, although they were next to healthy cells in the center of the limb, showing that the radiations had not affected the healthy parts.

### THE LENGTH OF TREATMENT

Another plant was treated in the same way, except that it was exposed 11 times, for three hours each time, to the radiations of the oscillator. Sixteen days after the first exposure the tumors, which were rather large as shown in one of the photographs, began to shrink and dry up and were easily detached from the limb exactly as in the first case. Again in this case, the healthy parts of the plant were not affected in the least. A third plant exposed to the radiations for nine hours, that is, three treatments of three hours each, was cured in the same manner as the two others. Sixteen plants also innoculated with cancer, were left without treatment. They have tumors in full activity, several of which are very large. These experiments show conclusively that plants innoculated with cancer can be treated and cured by means of the ultra radio frequency vibrations, whereas surgical treatment fails.

Mr. George Lakhovsky

"In conclusion I wish to call the attention of the reader to the fact that I have obtained very conclusive results not only with a wave-length of two meters, but with longer and shorter wave-lengths. The main thing is to produce the greatest number of harmonics possible."

Such are the results of my researches with plants. At the present time, similar experiments are being carried out with animals and it seems that the effect on cancerous animals is the same as on cancerous plants.

I am highly pleased to present my theory and the results of my work in a scientific review of the United States, this great country, which has always been in the lead in the fight against this terrible sickness, cancer, and whose sympathy and help I would greatly appreciate.

# Hoover Wants No New Radio Laws

THAT any further radio legislation will hinder the proper progress of the science is the opinion of Secretary of Commerce Herbert C. Hoover.

The only change, which Mr. Hoover desires, is in the first section of the law passed in 1912 relating to the control of the Government over the licensing of transmitting stations. He wants Congress to change this provision of the law so as to give the Secretary discretionary power over the wave-lengths, power and times of transmission of all stations of American registry.

The full text of his letter to Chairman White is as follows:

### THE LETTER

December 4, 1924.

"Hon. Wallace H. White, House of Representatives, Washington, D. C.

"My dear Mr. White: I am inclosing herewith a suggestion of a very short bill, clarifying the powers of this department as to radio regulation as to interference. It does not pretend to confer complete regulatory authority, nor does it cover many matters, which must sooner or later receive legislative attention. It is intended only to enable the department to retain firm control of a situation, which is very rapidly changing, in which there are some elements of danger. If such a bill is passed, it will give time for more consideration of the whole subject.

"We have long agreed that this industry will ultimately require exhaustive legislation, and you have given a vast amount of valuable time, care and study to the subject, not only as manifested by the bills which you have introduced, but by your co-operation in the annual radio conferences we have held. I have, of course, been in full sympathy with your efforts.

"I feel, however, that the new developments in the art during the last twelve months have taken such a departure as to require somewhat further time for ascertaining its ultimate result to the public before we can adequately determine the proper course of legislation. There is a probability that by the end of that time we may require wholly new legislative provisions.

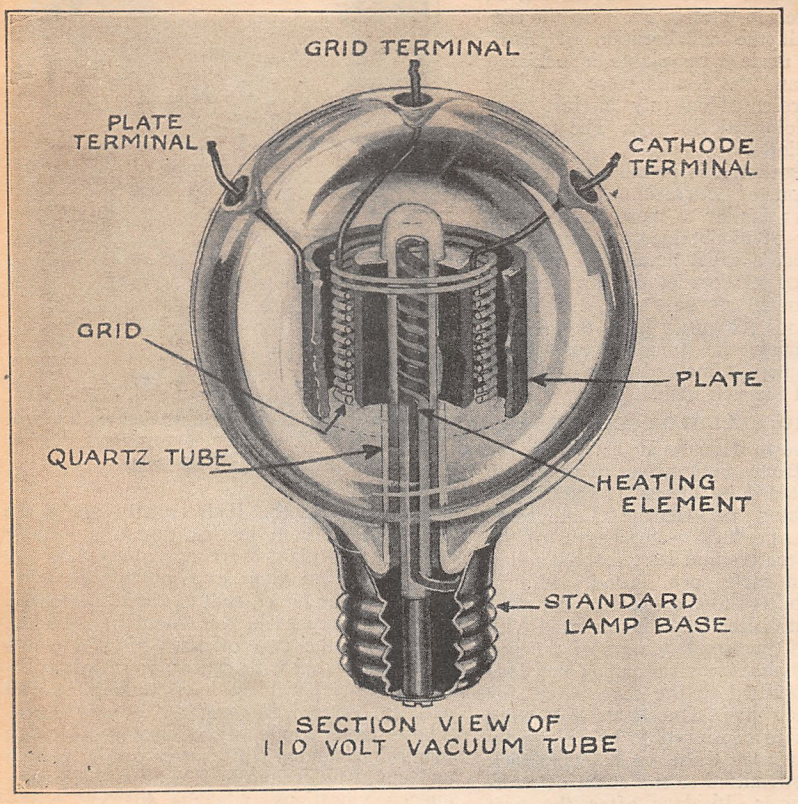
"The short bill proposed will reinforce the fundamental situation, so that no public damage can result from delay, whereas much public advantage might result from a further clarity of our knowledge as to the application of this new system of communication. As you are aware, there is no monopoly in the radio world at the present time, there being more than 500 broadcast stations, of which not more than four are the property of any one institution.

"With only 57 wave-lengths and 500 stations—rapidly increasing— we are today forced to certain duplications of waves and to the division of time between stations. If there were enough wave-lengths for all, the matter would be much simpler. Any attempt to give preference among stations in the allotment of wave-lengths on the basis of quality of programs raises the question of censorship, the implications of which I cannot at present accept.

"Beyond this, three major things have developed during the last twelve months. The

(*Continued on page* 1464)

# New Developments of Vacuum Tubes




SECTION VIEW OF 110 VOLT VACUUM TUBE

This drawing will serve to give the reader an idea as to what the new 110-volt vacuum tube will be like. The heating element in the center is removable so that a new one can be inserted, when the one in use burns out. This element serves only to heat the cathode element, which provides the necessary emission of electrons.

THE development of the equipment used in radio broadcast stations and receiving sets has been more than rapid—it has been phenomenal. Almost daily new circuits or apparatus are announced to the public and the outfits of yesterday are declared obsolete.

However, there has been one piece of apparatus that has become almost standardized—the three element vacuum tube. It is true that refinements have been introduced, but the tube itself remains unchanged. At present there is a vacuum tube in the process of development in which there is incorporated a radical change in construction.

The tube is so designed that it will operate from the 110-volt house current with no supplementary devices. Think what a step forward this is! No more storage batteries to worry over and no more sore arm muscles caused by carrying home fresh supplies of dry cells. All that is needed is to plug in on the house current and the tubes will operate.

The tube may be operated from either an A.C. or D.C. supply and as this current does not enter into the circuit of the set, it may be used as the "B" battery, with proper filters.

The entire structure of the tube is new, except the familiar grid and plate. The base fits a standard Edison light socket, instead of the present type of tube sockets. An advantage arising from this is that the grid and plate leads are kept separate, being brought through the top of the tube. Until now the noises from tubes operated from lighting circuits have been excessive, but there is a complete elimination of "hum" or "ripple" with this tube.

One of the greatest advances made in the construction of this tube is that the filament or heating element is *renewable* at a small cost. However, this need not alarm the fan, as the heating element is said to have ten times the life of the present day filaments. Also the electronic emission is almost indefinite, so there is no danger of the tube going "dead" suddenly.

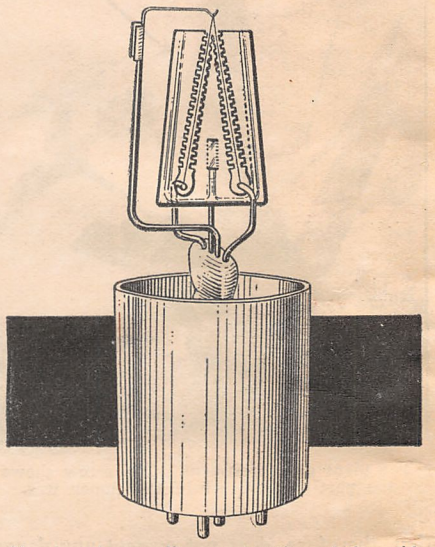
As may be seen in the accompanying sketch, there are three indentations in the glass bulb, through which are brought the grid, plate, and cathode leads. The exhaustion tip is at the lower side of the tube.

A thin quartz tube is fastened to the base and extends up into the tube. This quartz tube is sealed at the upper end and is open at the lower end to permit the insertion of the heating element. This element is formed of Nichrome resistance ribbon spirally wound on an "alundum" rod, which is made fast to the base by the screw in the bottom. The electrical connections to the heating element are made to the base screw as in an ordinary electric lamp.

There is an "alundum" sleeve that fits tightly over the quartz tube inside the evacuated bulb and this is the cathode or electron source, corresponding to the filament of the present day vacuum tubes. The heating element within the quartz tube heats this "alundum" sleeve to a red heat, in which state it becomes an excellent emanator of electrons. The grid of the tube is a fine wire mesh cylinder, suspended from the top of the bulb by its connecting wire. The grid is in the usual place between the cathode and the plate, which is a metal cylinder and also suspended from the bulb's top by its connecting wire.

When the current is applied to the tube the heating element becomes red hot. The heat is conducted through the quartz tube to the "alundum" sleeve or cathode, which is heated to a dull red temperature. In this state "alundum" becomes an excellent emitter of electrons and because of the large surface of the cathode a greater number of electrons are emanated per unit area per unit of input energy.

This method of heating the cathode is the only change in the tube's operation, the remaining action being the same as a C-301A or any other tube. The current consumption of the tube's heating element is about the same as a 50-watt lamp, which costs about one half cent per hour to operate.

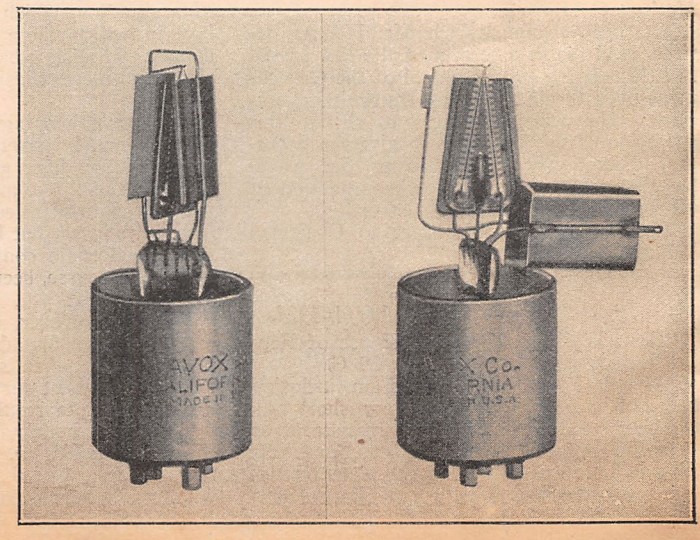


Showing the peculiar construction of the grid member in the new Magnavox tube. It is placed parallel to the plane of the filament.

### THE MAGNAVOX TUBE

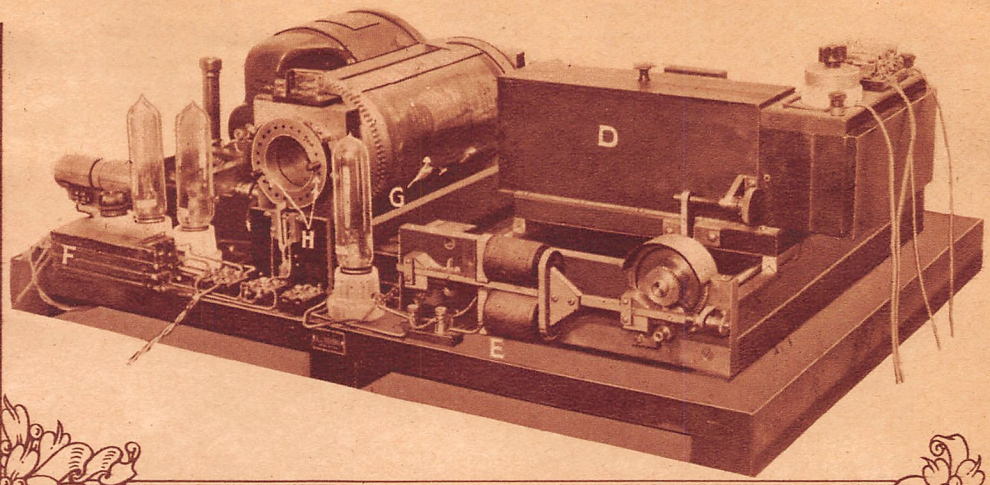
Another departure from conventional design is embodied in the Magnavox tube, the internal construction of which is shown in the photographs. In the ordinary tubes the grid is placed between the filament and the plate, but in this tube the position of the grid is changed in order to lower the impedance

(*Continued on page* 1551)



Two photos showing the internal construction of the new Magnavox tube. A double plate is employed, as in the usual type of vacuum tube. Note the unusual construction of the grid. It is a plate with two slits running through it, with saw-toothed edges which meet at the top. The filament is suspended between the slits.

A photograph of President Coolidge as reproduced on the receiving apparatus of the Photoradiogram system.




The transmitting apparatus. G is the glass cylinder, D the photo-electric cell and E the electromagnet operating the gear which moves the lamp and the photo-electric cell along the cylinder.

# The Photoradiogram System In Trans-Atlantic Tests

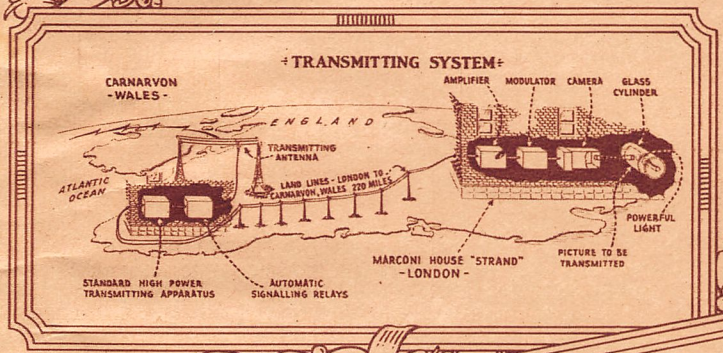
THE first public demonstration of the Radio Corporation's "Photoradiogram System," the transmission of photographs by radio, was given on Sunday, November 30, when the photographs of well-known men of the world were flashed across the Atlantic Ocean and reproduced at this end of the circuit, at Broad Street, New York City. A description of the system follows:

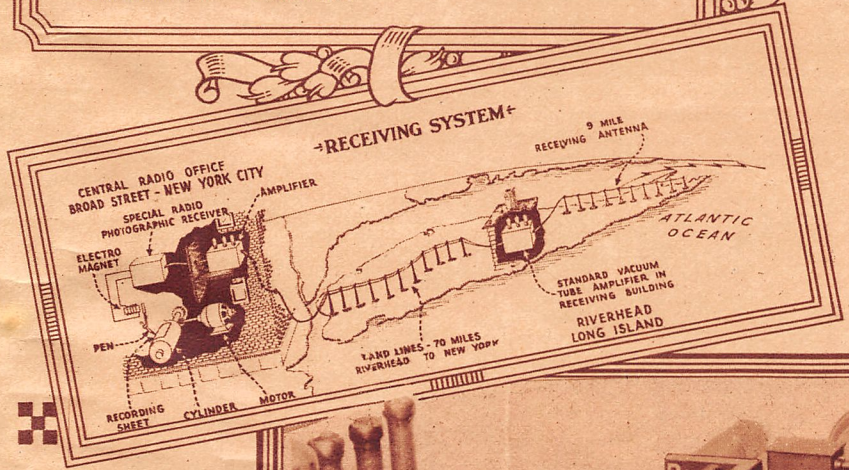
For the actual operation of the transmitter, the picture, printed matter or whatever is to be sent, is first photographed on an ordinary camera film. This is developed and then placed on a glass cylinder, being held firmly in place by metal clips. The picture is now ready to be transmitted.

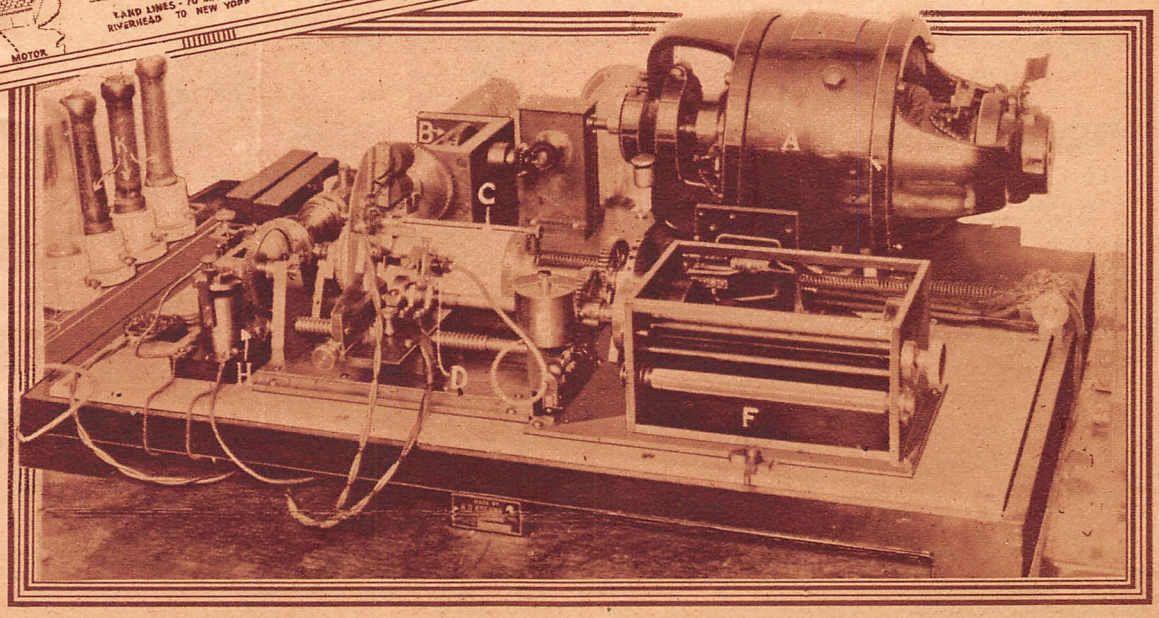
### LIGHT PENETRATES FILM FROM INSIDE

Inside this glass cylinder is an incandescent lamp, the light from which is focused in a minute beam onto the film as the cylinder is set in motion. As the light and dark portions of the picture are transversed by the light beam, the intensity of the ray is changed. This ever changing beam, after having passed through the film, is again focused through another lens outside the cylinder onto the sensitive element of a photo-electric cell, a recent development of the General Electric Co., which transforms the

(*Continued on page* 1456)



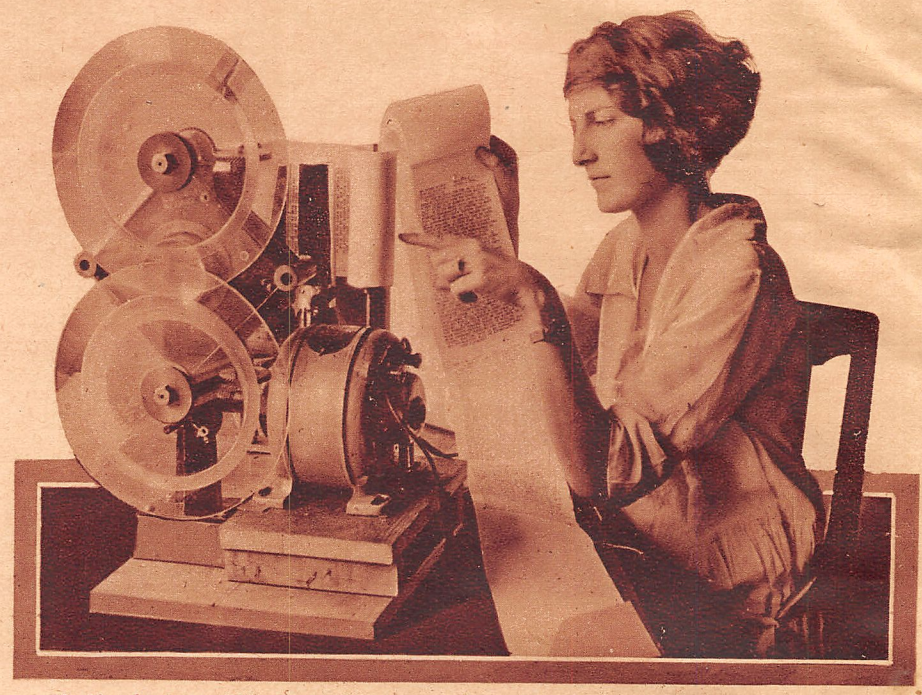




The sketches above show how the pictures are sent and received over land lines before reaching the transmitter and after being received by radio. On the right is a view of the receiving apparatus. The pen, D, marks dots on the paper stretched on the revolving cylinder, C, producing the effect shown in the sample picture.

# The Radio-Photo Letter

## By S. R. WINTERS

*SOMETHING new under the sun is an apt phrase to employ in connection with Mr. C. Francis Jenkins' radio-photo letter system. This apparatus is the result of experiments carried on in the transmission and reception of visual objects, either moving or stationary. This new system will certainly play an important part in the field of business.*



Machine for transmitting typewritten copy on long strips as a continuous process. A hundred words a minute is not difficult, and one thousand words a minute will soon be possible, it is believed.

"DON'T write; send a telegram," the slogan of a telegraph company may be modified in the future so as to read, "Don't write or telegraph; send your letters by radio." For the latest invention in the radio field allows the transmission of exact facsimile copies of letters, type or hand written direct. The received message is exactly like the transmitted one, even to ink blots on the paper. This method of transmission is called the radio-photo letter.

C. Francis Jenkins has devised the apparatus for the transmission and reception of written messages. Instead of sending communications by means of dots and dashes common to telegraphy, photographic impressions of letters are sent and received, faithful to the manner in which they were written.

The radio-photo letter is one of the three lines of development in which Mr. Jenkins is primarily concerned; the other two being photographs by radio and radio television. The three projects are closely related and the principles underlying their operations are so nearly identical that only slight modifications of instruments and equipment are necessary to change from one to the other. However, the transmission and reception of both photographs and letters by radio is an accomplished fact; while radio vision, or the ability to see distant objects and look on distant scenes has not advanced beyond a laboratory experiment.

### PRINCIPLE OLD

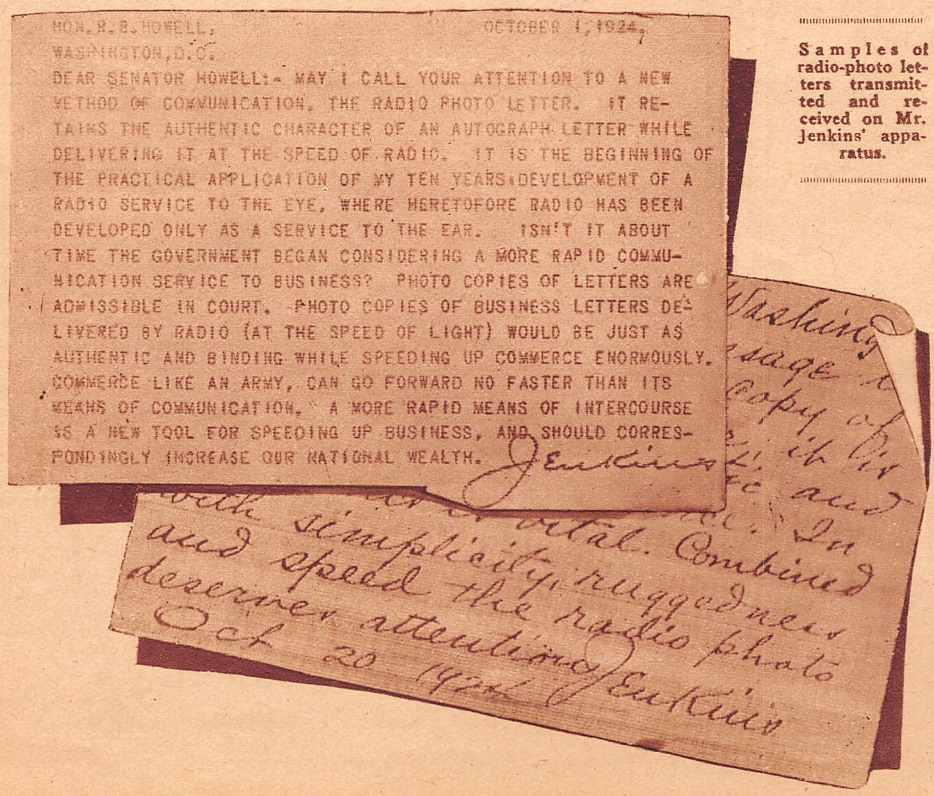
The principle of sending and receiving business letters by radio is not new; the novelty of the thing is in its application. That is, instead of a business man, banker or merchant communicating by means of telephone or telegraph, as formerly, he has a letter typewritten and transmitted at a speed of 186,300 miles a second. The communication thus dispatched retains the authentic character of an autographed letter. For instance, handwriting or signatures to typewritten letters are faithfully transmitted and received; there is no doubt as to the authenticity of a communication thus transmitted. Radio photo letters are sent at the rate of 100 words per minute, although it is anticipated that the speed may be increased to 1,000 words a minute.

"Radio messages in facsimile," states Mr. Jenkins in a recent interview, "of handwriting, signature and explanatory sketch not only can be sent in speed competition with code telegraphy, but they have unusual tactical value to the Navy and Army, for this is the only method of radio communication which may carry its own authority by the addition of the autographic signature of the sender.

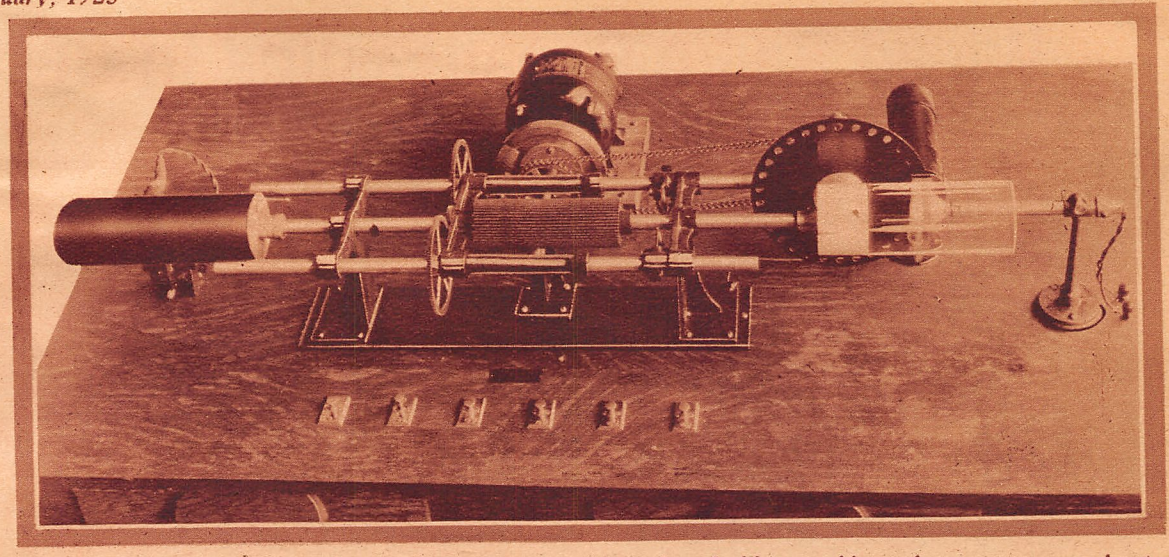
The mechanical means of transmitting and receiving business letters by radio is that of the so-called cylinder method. The operation depends upon the synchronous rotation of two cylinders. The apparatus is not new; in fact, Mr. Jenkins picturesquely claims that the mechanical parts were recovered from his "museum" and that they are at least 15 years old. Modern technique has been applied to this old machinery and as a result a combination device for both sending and receiving has been produced for commercial use. The cylinder method is employed by the American Telephone & Telegraph Company for the transmission of pictures by wire one unit being used for sending and another for receiving.

There are, however, physical limitations to the cylinder method in both transmitting photographs and typewritten letters. For instance, the device of Mr. Jenkins, shown for the first time in one of the photographs illustrating this article, is limited to the sending and receiving of the number of words contained on a telegraph blank at one time. Then, too, this particular machine cannot be employed for picture transmission.

Drawing a comparison between the utility value of the transmission of photographs and typewritten communications, Mr. Jenkins states: "Of these one naturally thinks first of pictures for news illustration of telegraphic text in the daily newspaper. But it is more probable that the transmission of radio photo news copy will be the most useful service, for this method overcomes time,


HON. R. B. HOWELL, OCTOBER 1, 1924.
WASHINGTON, D. C.
DEAR SENATOR HOWELL:- MAY I CALL YOUR ATTENTION TO A NEW METHOD OF COMMUNICATION, THE RADIO PHOTO LETTER. IT RETAINS THE AUTHENTIC CHARACTER OF AN AUTOGRAPH LETTER WHILE DELIVERING IT AT THE SPEED OF RADIO. IT IS THE BEGINNING OF THE PRACTICAL APPLICATION OF MY TEN YEARS DEVELOPMENT OF A RADIO SERVICE TO THE EYE, WHERE HERETOFORE RADIO HAS BEEN DEVELOPED ONLY AS A SERVICE TO THE EAR. ISN'T IT ABOUT TIME THE GOVERNMENT BEGAN CONSIDERING A MORE RAPID COMMUNICATION SERVICE TO BUSINESS? PHOTO COPIES OF LETTERS ARE ADMISSIBLE IN COURT. PHOTO COPIES OF BUSINESS LETTERS DELIVERED BY RADIO (AT THE SPEED OF LIGHT) WOULD BE JUST AS AUTHENTIC AND BINDING WHILE SPEEDING UP COMMERCE ENORMOUSLY. COMMERCE LIKE AN ARMY, CAN GO FORWARD NO FASTER THAN ITS MEANS OF COMMUNICATION. A MORE RAPID MEANS OF INTERCOURSE IS A NEW TOOL FOR SPEEDING UP BUSINESS, AND SHOULD CORRESPONDINGLY INCREASE OUR NATIONAL WEALTH. Jenkins

Samples of radio-photo letters transmitted and received on Mr. Jenkins' apparatus.



The machine for sending radio-photo messages and for receiving at the same time. For such a complicated performance the machine is unusually simple in its make-up.

distance, isolation, storms and breakdowns of the usual means of communication, and serves a thousand daily newspapers at no more expense than service to a single patron. Nor does radio interference and 'static' prevent the reception of perfectly readable copy. A hundred words a minute from typewritten copy is an everyday attainment already, and one thousand words per minute soon is confidently predicted.

"As more than 70 of the great newspapers of the country already have radio broadcast stations, attaching these simple radio photo sending-and-receiving instruments would insure the newspapers against interruption of news service by the breakdown of present telegraph lines; if indeed they did not find it a better and faster means of exchanging news with each other, as well as service to newspapers which have no broadcast stations but install a radio photo news receiving camera.

"Transmitting messages by reducing the words to letters and each letter to dots-and-dashes, right enough in 1840, seems terribly antiquated today. Photography is the most rapid means of copying anything, and radio is the swiftest means of communication."

The application of this new method of communication—the radio photo letter—finds an illustration in the possibility of sending and receiving the headlines of the front page of a newspaper in this manner. For instance, a newspaper published in one city and having a large number of subscribers in a nearby town could broadcast its headlines hours ahead of the arrival of the printed newspaper. Discounting the contention that most readers of newspapers merely scan the headlines, in this case persons desiring full details could obtain them upon arrival of the printed pages.

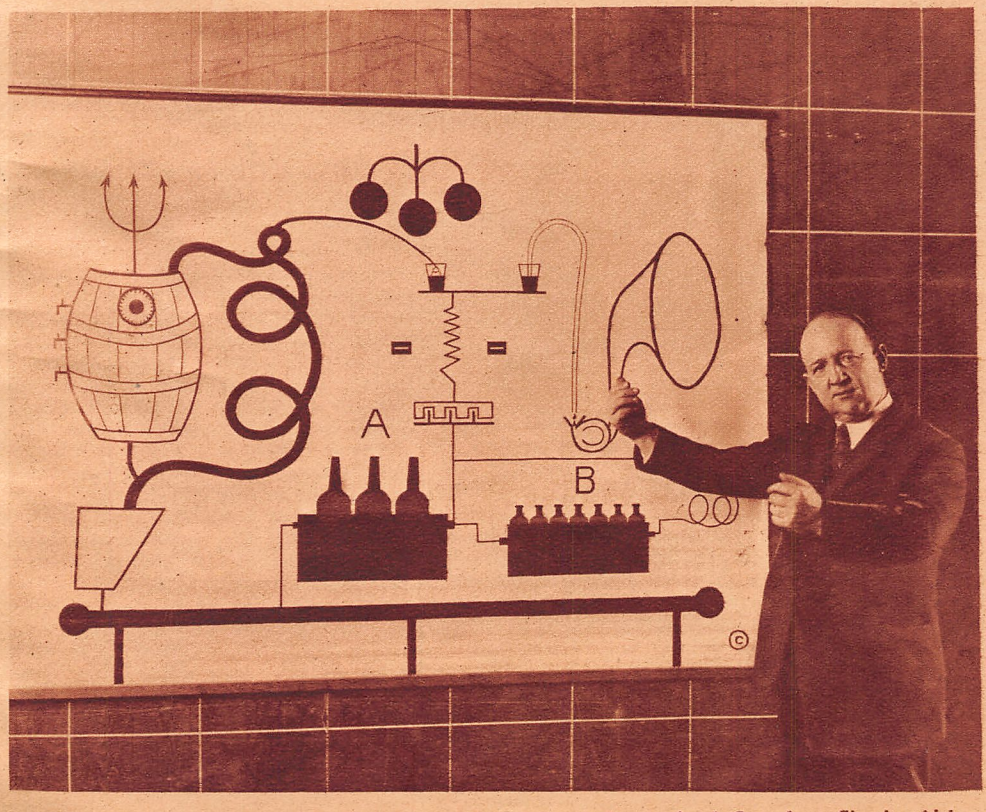
### SPEED COMMERCE

Business letters by radio, according to Mr. Jenkins, would speed up commerce and yet such communications would be none the less authentic and binding. These same letters, because of their photographic accuracy and autographic authenticity, would be admissible as evidence in court. In time of war, these photographic impressions would constitute an autographed order and would command obedience thereto.

"We don't particularly need any special frequency band, nor does the use of our devices in any particular way interfere with other stations. Radio engineers have been working in the very limited audio frequency band, a range of a relatively few cycles, somewhat comparable to the old long wave limitation, whereas the workable range where light instead of sound is employed goes up to millions of cycles. I confidently predict that the next great development is in this area. Incidentally, there is this advantage also, in the use of light instead of sound, the bite of the 'static' is not fatal."

# The Cornadyne Circuit

## By H. N. SESSIONS, R. F. D.*




The author explaining the wonders and blunders of the new and sensational Cornadyne Circuit which experts have said will revolutionize the conventions of high society and place everyone on an equal footing—if any.

SING a song of Dry Docks,
The holds are full of rye
And the Captain's on the poop deck
With calm and watchful eye.

Four and Twenty Scoflaws
Are tuning in their set
For the Captain on the poop deck
Has a hook-up that's all wet.

The four of them, the Chief Engineer, the Booster of Sales, the Manager and the Laboratory Consultant sat about the table, watching their cigar smoke imitate swallows homeward flying.

Said the Manager: "'Tis high time we gave the thirsting public something entirely new. They crave our handiwork. A brave new set must be served the noble and waiting mob."

Said the Chief Engineer: "Ho, they wait without."

Said the Laboratory Consultant: "Without what?"

Said the Chief Engineer: "Without the Cornadyne," as he twirled a nut off the steam condenser.

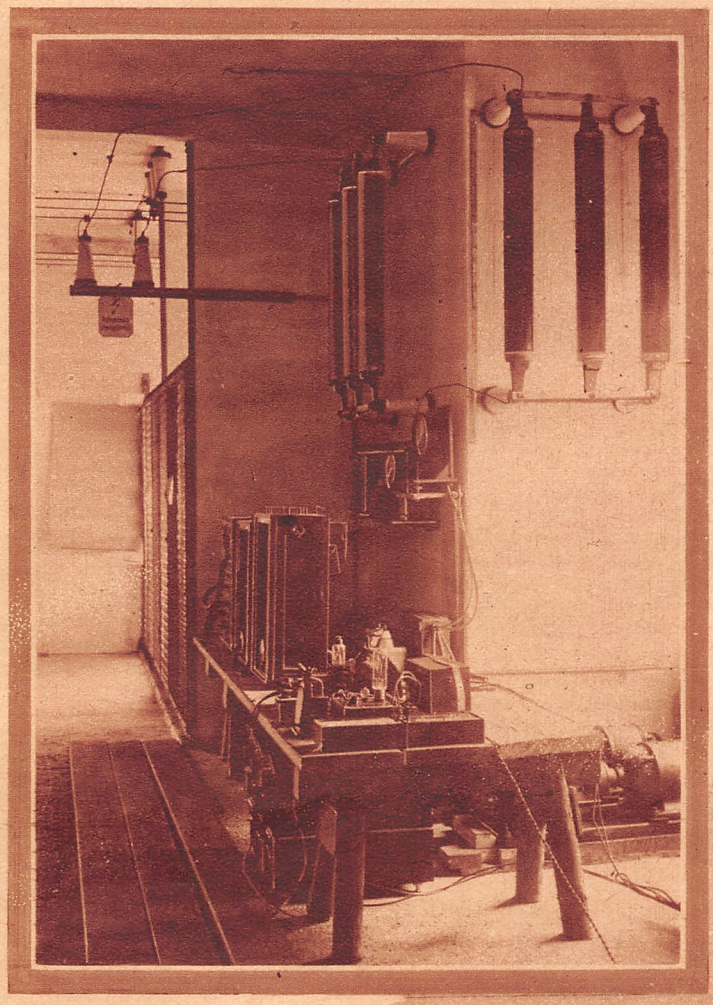
Said the Manager: "Tell us about this child of your midnight oil and oily night caps," as he induced the third seidel thereby reducing his capacity to 10$^{0}$—1 seidel.

(*Continued on page* 1543)

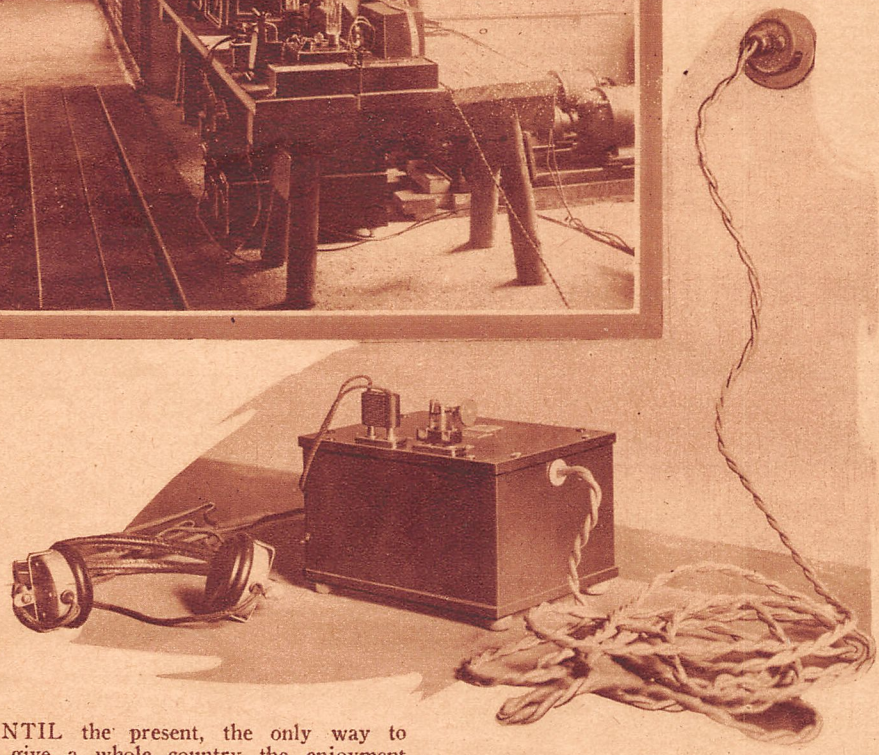
* *Right Free Delivery of Speech.*

# Wired Radio Broadcasting In Germany

## By DR. ALBERT NEUBURGER



Left: The transmitting apparatus in one of the rooms of the power plant at Altenburg, that super-imposes the modulated oscillations upon the network of feed wires of the lighting circuits. In the right background may be seen the two rotary converters which supply the current for the operation of the transmitter, in the foreground the vacuum tube speech amplifier and above, attached to the wall, the condensers. In the photo below is shown the special receiving set which is attached directly to the home light socket by a plug.



UNTIL the present, the only way to give a whole country the enjoyment and possibility of listening to radio, was to increase the range of the broadcast stations or to establish new ones powerful enough to cover the entire territory. But even with the aid of increased power and long range there remained sections where reception would be poor.

A new type of transmission, installed very recently in Germany, will be a great benefit. It is called "E. W.-Rundfunk", that is — Electricity — Work — Broadcast. In cases where the range of the broadcast station is insufficient, the electrical power and light companies will take up the program and retransmit it with the aid of their power lines using wired radio. In the future, these power plants will supply, by the same lines, not only electrical current for power and light, but also music and lectures.

The first power house adapted to this purpose is the long distance station at Altenburg. The Berlin transmitter has a range of 93 miles. Altenburg is situated 130 miles from Berlin and supplies the current for about 28,000 consumers in a circumference of 38 miles. By help of the Berlin-Munich underground telephone cable or the overhead telephone lines all the music or lectures given into the Berlin microphone will be transmitted to the electrical central station at Rositz near Altenburg. There the sounds arriving in the manner of ordinary telephony on wire are transmitted, after double amplification as radio signals over the power line. The electric waves go from the transmitter to the power lines. The power current flows in the lines without being disturbed by the radio frequency current which in turn is not influenced by the other.

### THE TRANSMITTER

The transmitter itself is installed in two rooms, the first contains a simple tube amplifier and a telephone which allows the control of the clearness and strength of the incoming signals. From the first amplifier the current flows to the principal transmitting room where it passes through a second tube amplifier. The power for the main transmitter is supplied by the lines. This line current first is converted from A.C. to D.C. The electric waves are produced by a tube transmitter of common type. The oscillations set up by the high frequency apparatus can be passed on to the line by either an inductive or capacitive coupling. At present the transfer is effected by capacitive coupling with special condensers which avoid the entrance of the line current into the transmitter, but allow the radio frequency currents to pass onto the supply mains.

The installation is working at the present time with an output of 200 watts, which will be increased in the near future to 1½ kilowatts. It is interesting to notice that atmospheric disturbances are neutralized and do not influence the clarity of reception. The subscriber at his convenience can take from the wall socket, light and power as well as music or lectures. He has only to connect a crystal set to the socket in the same manner as he would connect a lamp, toaster or flat-iron. No antenna, ground, lightning protector or tuner is necessary, as only a single wave-length of 6,000 meters is used. The wave-length prohibited to amateurs has been chosen in order to prevent the installation by unlicensed listeners. Receiving is only possible with a set of special construction which must be hired from a Post Office. The operation of this new installation is excellent, as the concerts transmitted from Berlin were audible with a remarkable clearness at Rositz where they were reproduced by headphones as well as by loud speakers.

## HOLLANDERS BUILD THEIR OWN SETS

MOST radio fans in Holland prefer to build their own sets, according to recent reports from Amsterdam, and consequently few purchasers of complete sets are to be found in the Netherlands. Dutch amateurs prefer the "three honeycomb coil system," few using variometers or variocouplers. European wave-lengths jump from 220 meters used by Brussels, to 2,600 meters by Paris. England uses from 360 to 420, Dutch stations 1,050 to 1,100, and Paris, 1,700 to 2,600 meters, a very wide range in wave bands, for a single set to pick up.

The use of honeycomb coils is necessary in order that the proper values of inductance may be readily obtained, which would not be possible over this broad band in sets constructed as most of the broadcast receivers are in the United States.

The Dutch have licensed six broadcasters, a tax of 100 florins a year being levied for an hour a week of broadcasting. The Government itself, however, plans to erect a station, but listeners in of the Netherlands still have the privilege of listening to radio concerts from British, German, French, Belgian and Swiss stations. The recent formation of a dealers' association is expected to aid in popularizing radio in Holland.

# *The Inventions of* Reginald A. Fessenden

Graduating class of Rev. E. J. Fessenden at McGill University.

## PART II

### HEREDITY

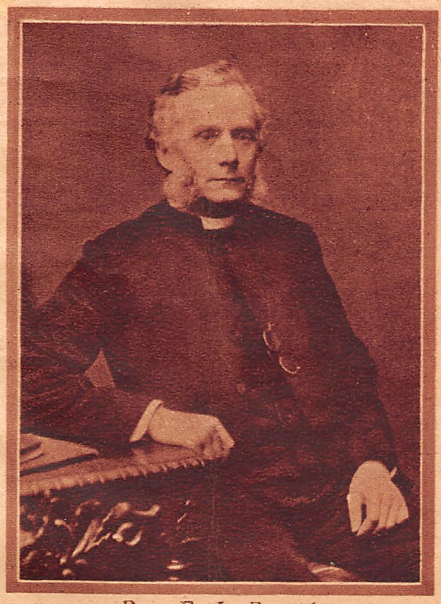
TO what extent is the incidence of this natural aptitude influenced by heredity? Galton has shown that capability in certain lines is inherited; is it so with inventive ability?

Taking first the great divisions of mankind, the different races, do some races make many inventions, others few, or none? If there is a marked difference, this would be an indication that heredity is an influence.

The best way to locate a property is to begin by excluding the elements which do not possess it.

### SEMITES

The Semites have had many great men in many fields, religion, economics, politics, trade, mathematics, music, but apparently not in invention. The Arabs were eminent in science; in astronomy, chemistry, mathematics, but made few or no inventions. Of the Jews, we may quote that competent Jewish authority, Jacob Funkelstein. When, discussing the Jewish trade schools in Palestine, Ashbee quoted Appolonius Molo, the teacher of Cicero, "The Jewish race is the only one which has never contributed any invention useful to life," Funkelstein replied, "It is true that Hertzel, Hess, Disraeli, Karl Marx, Ferdinand Lasalle, David Ricardo, Moses Montefiore and a few others who have moved the world in the 19th century did not work with their hands." (Leaves from a Palestine Note Book).



Rev. E. J. Fessenden.

Clementina Fessenden, the mother of Reginald A. Fessenden.

The Phoenicians spoke a Semitic dialect, for this was the best language for business in their time. But they were a composite race.

Our museums have glass vessels made thousands of years before the time at which the Phoenicians are alleged to have discovered glass. But they did invent, or were at least the most important agency in desseminating, the alphabet. The old style of writing in which a thing was represented by its picture, had become so conventionalized by the leaving out of parts of the picture that a business man had to carry around a large dictionary or syllabary, and then take his pick of a number of equivalents, to tell what sound a given set of marks represented. An alphabet system, one kind of mark to represent one sound, had become a business necessity, especially for people carrying on a big foreign trade. And they had a college for teaching navigation and wrote great histories. But they were mainly traders, and Breasted says that the Egyptians had a 24 letter alphabet B.C. 3500.

### ETHIOPIANS

There seem to have been at least two kinds of black races; one with very long noses, like those shown in Bank's "Bismaya", and cleverer than the other. But neither seems to have been inventive and both Etheopians and Semite (e.g. the Arabs) seem to relapse into a semi-barbarous stage when out of contact with other races.

### THE INVENTIVE RACES

The Greeks attributed most of the fundamental inventions to the Hypibereans, more generally known as the Hyperboreans, a North Caucasus race which had moved, possibly pressed by the Scythian tribes, to the valley south of the Caucasus range and beyond (Hyp) Iberia (modern Georgia). Many of the Greek institutions had been founded by Hypibereans in early times, and individual members of the race, e. g. Abaris, were held in high esteem by the Greeks. Pythagoras is believed to have obtained his learning and doctrines from them. (See Eusebius Arm. Chron.)

Other important inventions were attributed to the race which came from the peninsula of Circe, where Anapa is, between the Sea of Azov and the Black Sea, and which settled Corinth and Syracuse. Theophrastus says that Hyperbius of Corinth invented the potter's wheel; and Archimedes, the inventor of the pump used for irrigation in Egypt, and of many other devices, and a great mathematician, was a native of Syracuse. This also was a North Caucasus race.

(*Continued on page* 1450)

Norman Trenholme.

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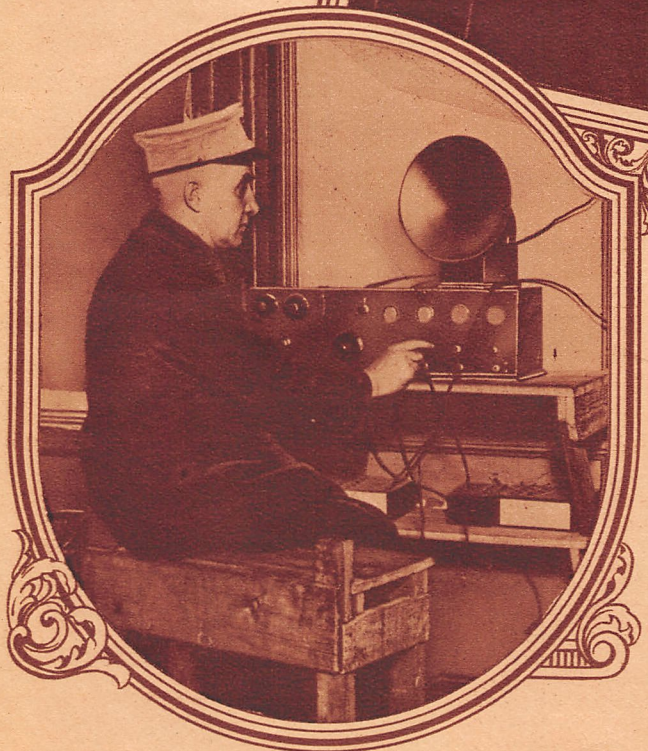
# Radio In the Vienna Fire Department

## By O. C. ZILISCH

### From An Interview with the Fire Commissioner, Anton Wagner, Head of the Vienna Fire Department

A TWENTY WATT TRANSMITTER of the type originally employed. These have been replaced by a new model.

(Above) One of the Vienna fire-prevention automobiles equipped with radio transmitting and receiving apparatus. Note the antenna, strung on the four poles attached to the front and rear of the car. Right: Anton Wagner, head of the Vienna Fire Department, listening in on the headquarter's radio receiving set.



RADIO KEEPS FIREMEN HAPPY during their few idle hours. The photo above shows Capt. Joseph Donovan, of Engine Company No. 8, New York City, listening to a concert on the new radio set installed in that firehouse. © Underwood & Underwood.

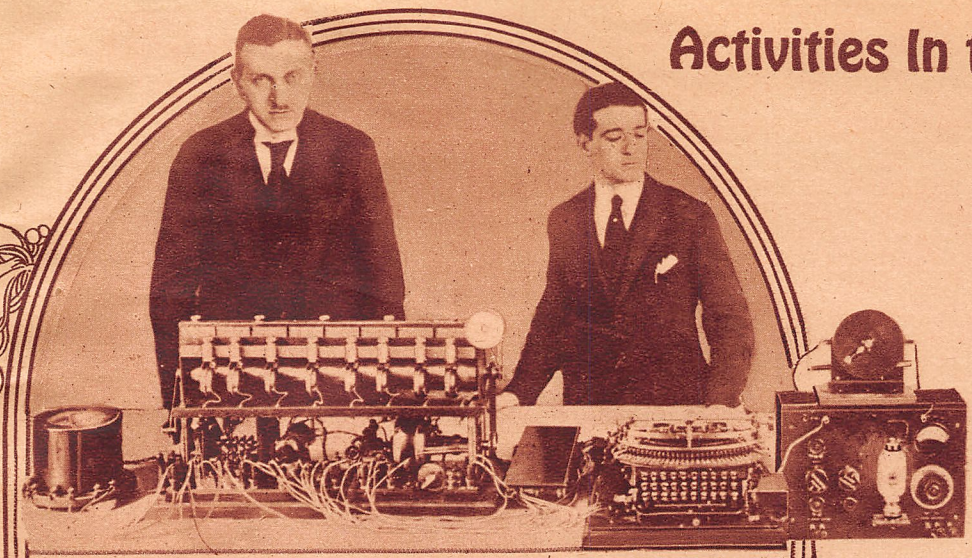
AMONG the Fire Departments of Europe the Vienna department takes a leading place. Its efficiency and promptness were testified to in the World Congress by the high praises it received. It has always striven to preserve its international fame by the introduction and study of modern methods; radio was here able to give most valuable assistance, and the Director-Engineer, Anton Wagner, was quick to recognize this and quickly converted his thoughts into action. The impulse to this was furnished by the very poor safety arrangements during the open air production of the Italian opera ensemble in the great Vienna Stadium, the wooden seats of which carried on their scaffolding an audience of 25,000, along with 1,000 employees, while telephone and fire alarm were five minutes off, so that if a fire broke out, much time would be lost. Accordingly, a complete radio transmitting set was installed and receiving sets were placed in the Fire Department's local building communicating with the same apparatus in the Central Office in the city.

#### A LESSON LEARNED

The valuable experiences that were evolved from the use of this station brought into closer realization the plan of equipping the auto fire engines with radio apparatus. Experiments in this direction have been carried on with the assistance of the city Government, since February of this year. In a remarkably short space of time—three days—the oldest radio concern of Austria, the firm of E. Schrack, delivered sending and receiving apparatus to the Fire Department

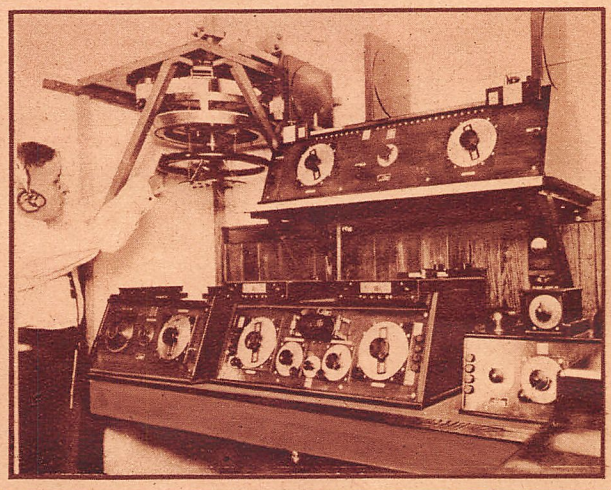
(*Continued on page* 1512)

# Activities In the Commercial Radio Field



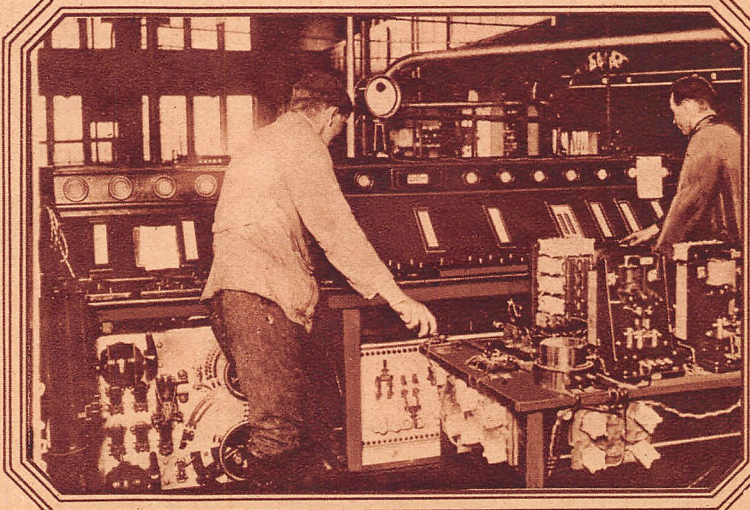
HIGH SPEED TRANSMISSION. A new system of transmitting commercial intelligence and news by radio which was invented by two German scientists has been developed and perfected by Mr. William Dubilier of condenser fame. The apparatus operates at a speed of 190 words a minute, but it is only limited by the capacity of the receiving apparatus. © Wide World Photos.

DR. J. H. ROGERS before the apparatus of his Submarine Radio System of which he is the original inventor. © Henry Miller News Picture Service, Inc.



GERMAN RECEIVER (above). A view of the receiving apparatus in the large station at Geltow, Germany, where messages from the United States are received every day. Note the operator setting the loop aerial. © The Gilliams Service, N. Y.

TRANSMITTER AT NAUEN (below). One of the rooms in the transmitting section of the powerful radio station at Nauen, Germany, where commercial messages are regularly sent to and received from the United States. Four hundred-kilowatt generators furnish the power for the operation of the transmitter which works on a wavelength of 12,600 meters. © The Gilliams Service, N. Y.



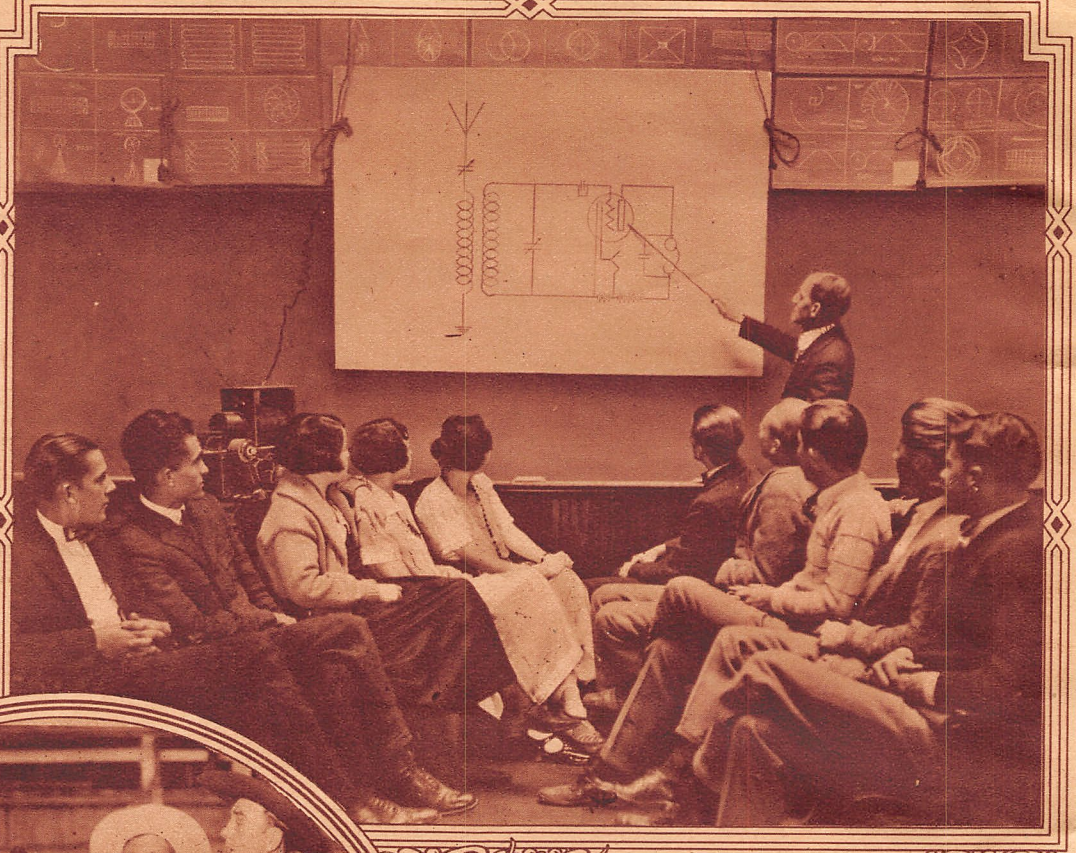
## DR. JAMES HARRIS ROGERS WINS LEGAL FIGHT ON RADIO PATENTS

THE patent covering undersea antenna system has been awarded finally to Dr. James H. Rogers, who has been defending his rights to it for five years in the Court of Appeals of the District of Columbia. This patent was first granted to Dr. Rogers in May, 1919, but later his rights were contested by the persons who assisted in installing his system under Government supervision.

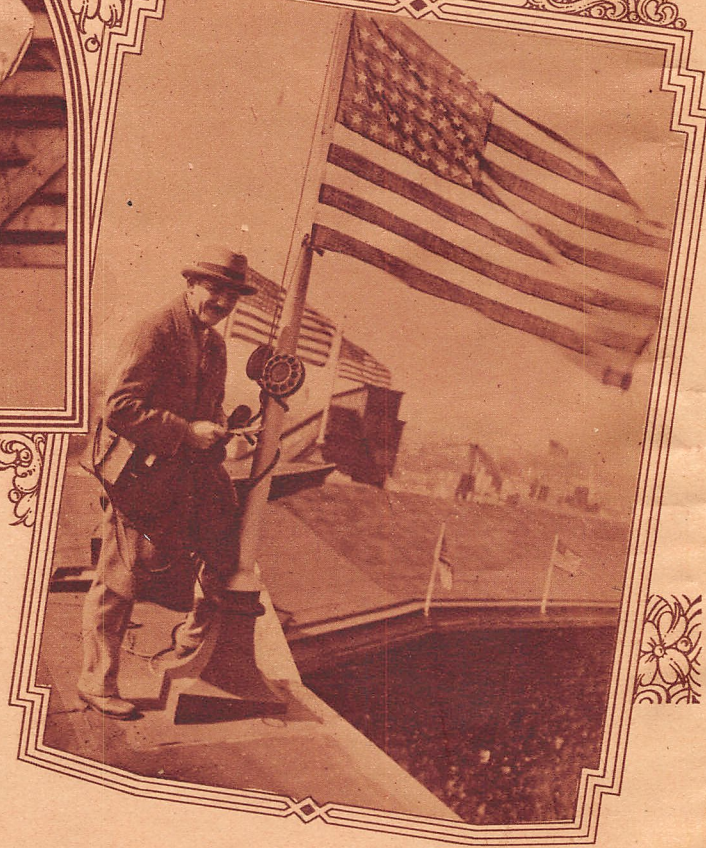
The patent covers a device connecting one end of an insulated wire to the bow of a submarine, and running thence back over the conning tower with leads to the receiving and transmitting apparatus, thence back to

(*Continued on page* 1510)

TEACHING RADIO WITH LANTERN SLIDES. Prof. F. G. Taylor instructing a physics class of Oregon (Illinois) High School, using lantern slides to illustrate the discovery, development and application of radio. The use of slides for the purpose of teaching a class the fundamental principles of radio is an original one and it would seem that the idea is superior to the usual system employed whereby the talk given by the teacher is relied upon to bring up a correct vision of the subject in the imagination of the pupils.
© Keystone View.

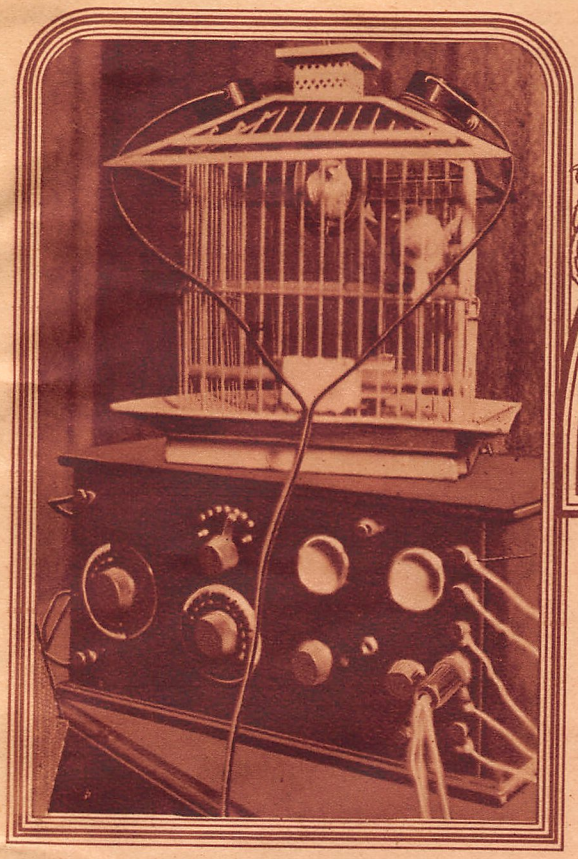


WILD WEST? NO! NEW YORK RODEO. Frequently between bouts with wild bounding broncos, the cowboys and cowgirls listened in to some of the wild ether waves. The Revolver? Just more atmosphere.

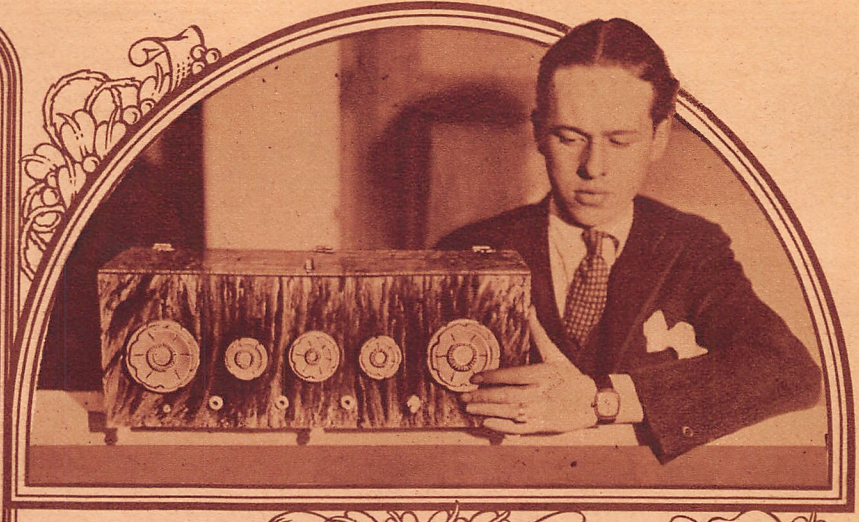


BROADCASTING GRIDIRON PLAYS. Sen Kaney, of Station WGN, on top of the grandstand at the Chicago stadium, telling about the battle raging far below.
© P & A Photos.

HIS MASTER'S VOICE? The Peruvian mosquito hound in the tumbler, which could be used for better purposes, is trying to decide if his master really wants him to jump in. © The Gilliams Service, N. Y.

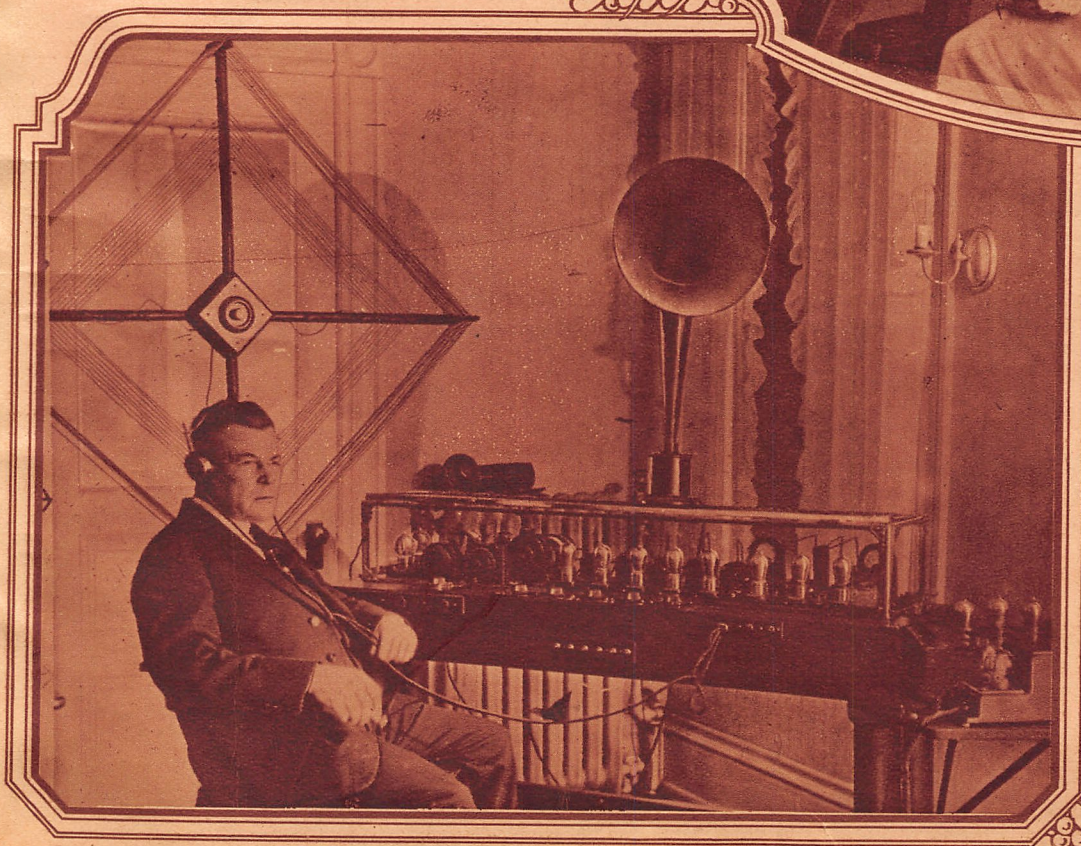


CANARY'S VOICE RESTORED BY RADIO. For some unaccountable reason the yellow warbler shown in the photo above had stopped his merry song and the owner, hearing of the wonderful results that were being obtained in aiding people to hear and speak by means of the radio, decided to try it out on the bird. It worked and again the silvery notes of the golden colored songster are heard throughout the house. © P. & A. Photos.

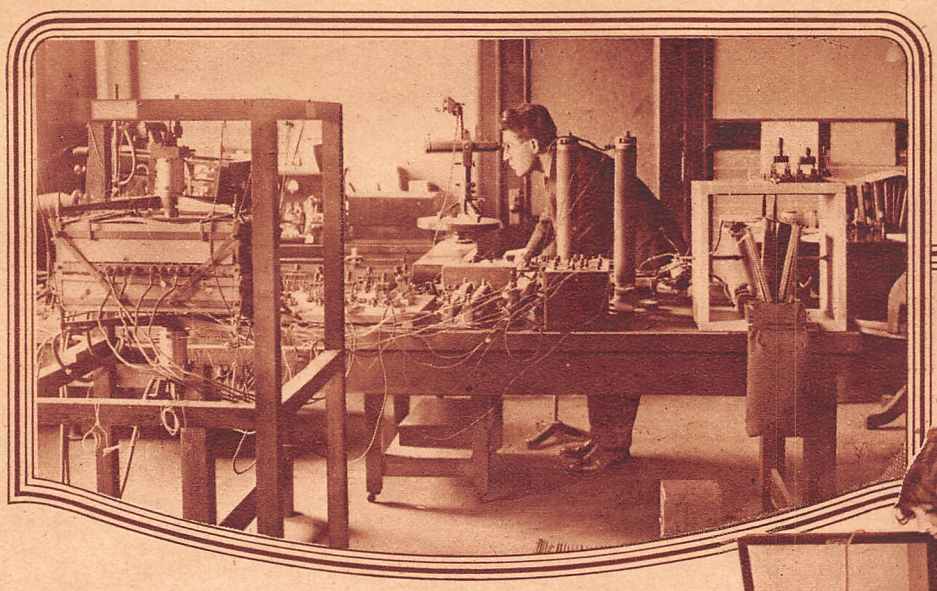


SOUR MILK was the material employed by Mr. L. Abrams of New York City in building the novel set shown above. He constructed the cabinet, panel and dials from sour milk, coloring it with dyes before it hardened. Mr. Abrams will gladly pass the formula along to any other radio fan. © Kadel & Herbert.

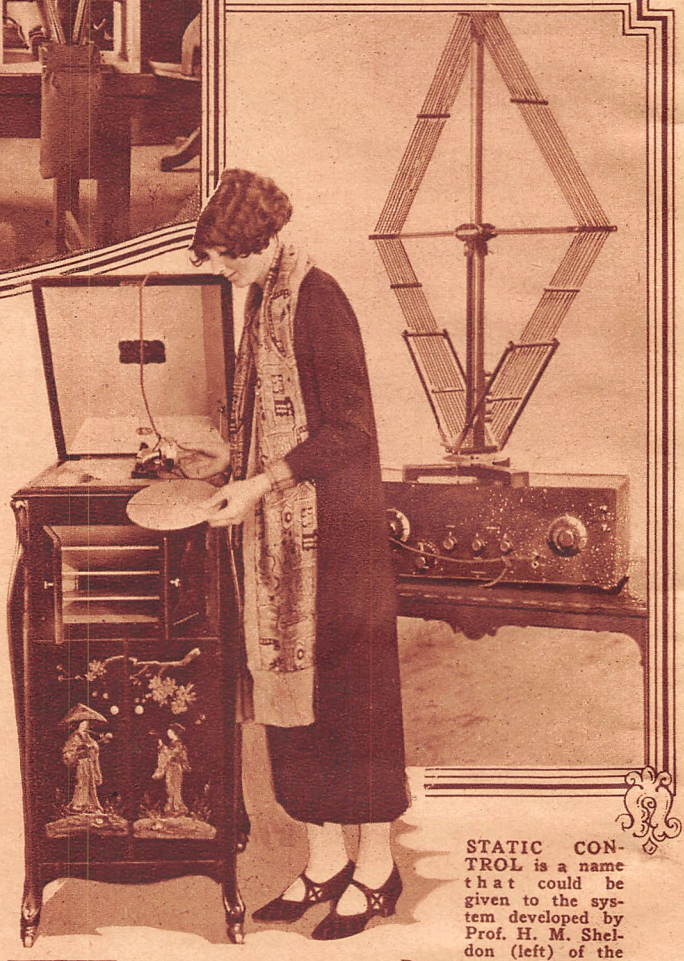
RADIO CRITIC. Miss Jennie Irene Mix at the dials of her receiving set in her home at Toledo, Ohio, from which central point she can tune in on practically every important station in the country. Her criticisms published in magazines and newspapers are read by countless thousands of radio fans throughout the United States. © K & H.



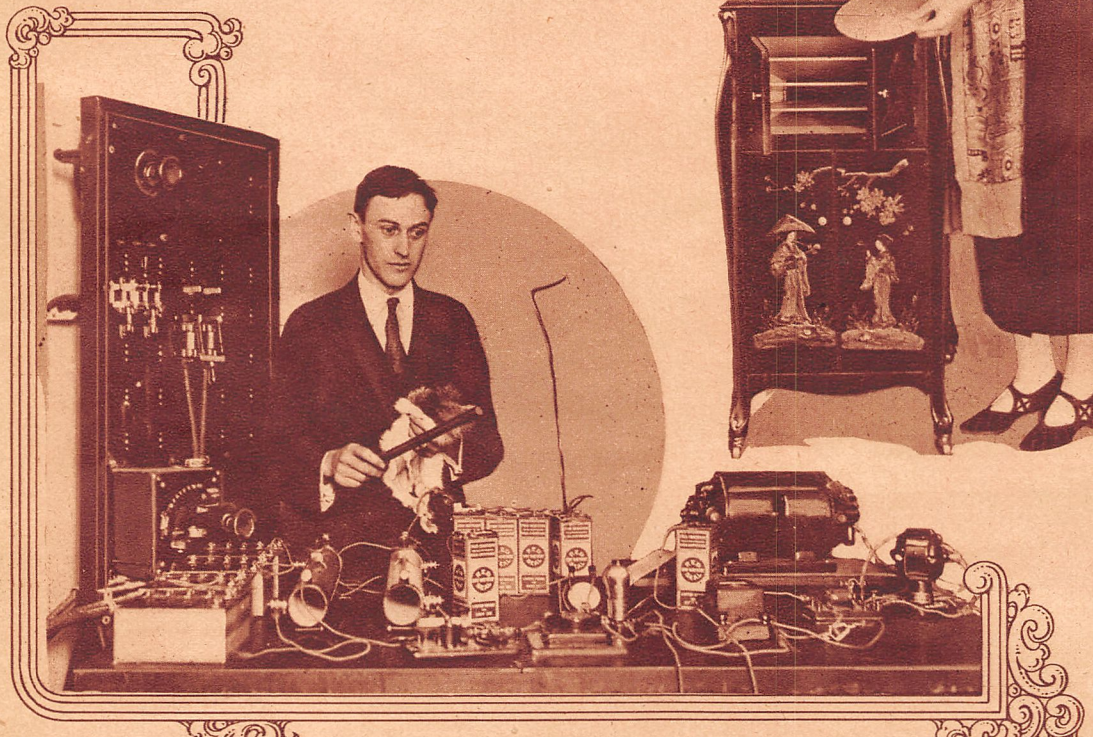
AN EIGHTEEN TUBE SUPER-HETERODYNE owned by H. H. Elmer, of Syracuse, N. Y., and which is the product of his own craftsmanship. He has heard Mexico City, the Catalina Islands, Rio de Janeiro, Bordeaux, France, and many other long distance stations. © Wide World Photos.



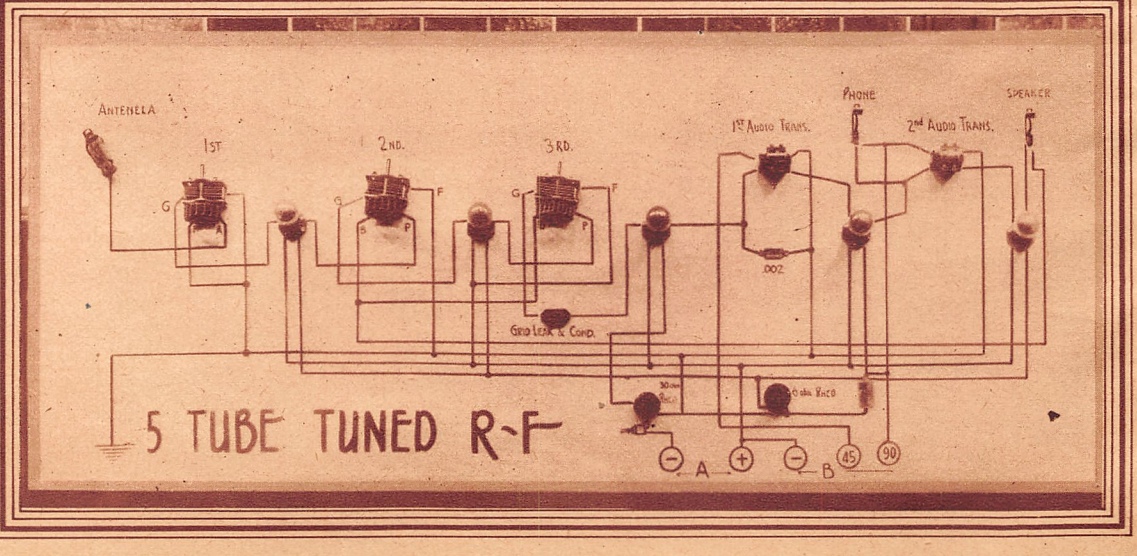
**TESTING INSULATING MATERIALS** for their heat conductivity is the latest investigation undertaken at the Bureau of Standards. Very delicate and complicated apparatus is required for the determination of the amount of transfer of heat through various forms of insulating material. The photograph to the left shows the layout of apparatus employed for this purpose. © Henry Miller News Picture Service, Inc.



**THE RADIO PHONOGRAPH** has come at last. At the right is shown Phyllis Barker operating the instrument. If a particular speech or concert interests you, all that is necessary is to press a button and the phonograph records it from the radio. This is what we call "canning radio programs for future consumption." "Oh Phyllis," calls mother, "put on 'Tosti's Goodbye,' as rendered by WJZ on the 16th instant." And Phyllis does—or doesn't. © P & A Photos.



**STATIC CONTROL** is a name that could be given to the system developed by Prof. H. M. Sheldon (left) of the Department of Physics of New York University. By rubbing a piece of ebonite with cat's fur and allowing the static electricity thus accumulated to effect a sensitive vacuum tube relay circuit he is able to control the actions of a 110 volt motor, starting and stopping it at will. "It's the cat's fur," says the professor,—"that does the trick." © Kadel & Herbert.

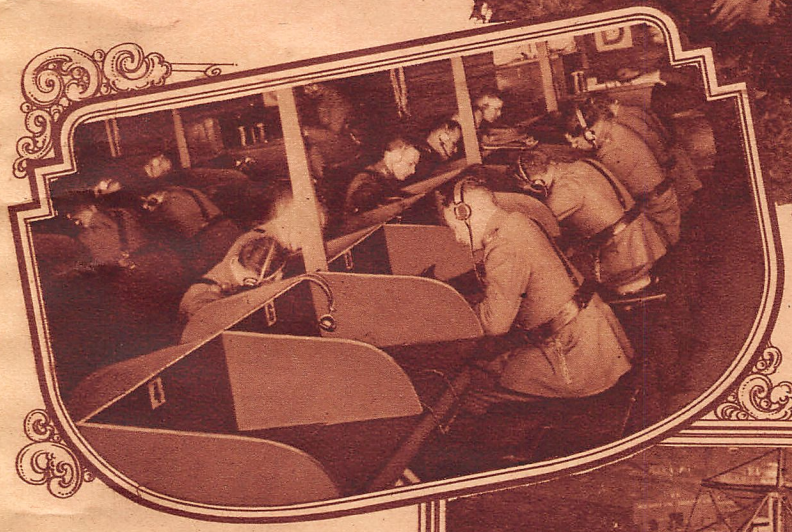



**A NOVEL DISPLAY** in the show window of the Newman Stern Co., Cleveland, Ohio, which has appealed to the radio public. The various parts required to make up a five tube radio receiver were mounted on a board, jacks and all, and the whole layout wired up exactly as it would be when built. (Courtesy Newman-Stern Company.)

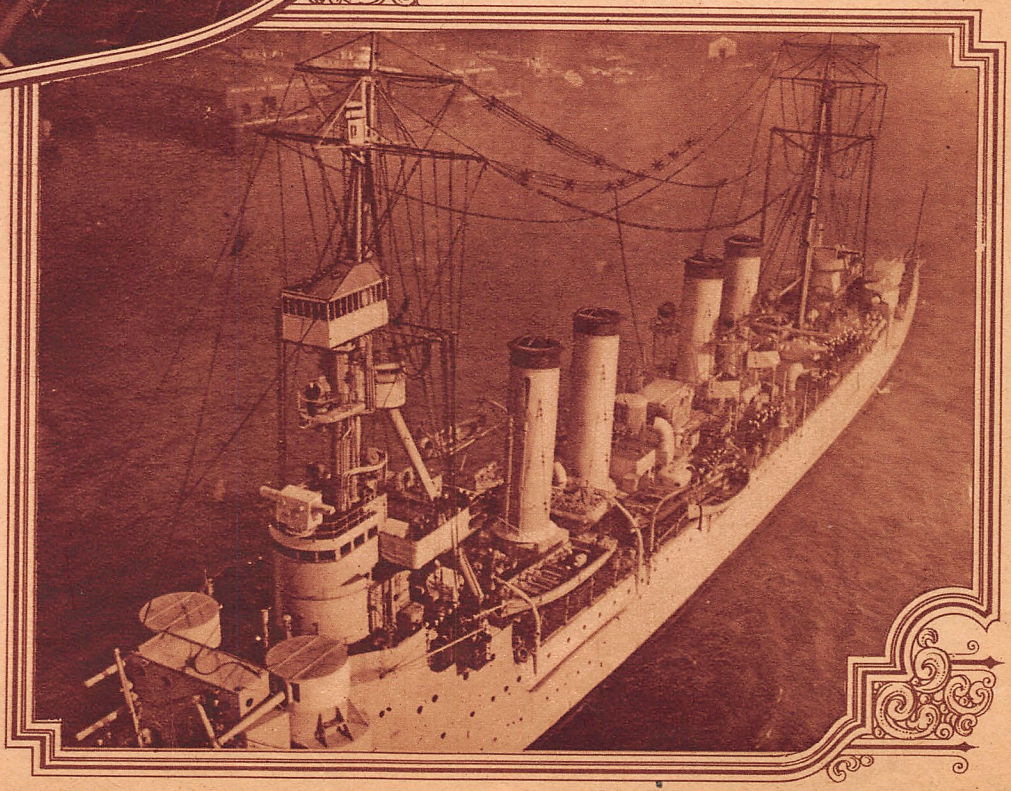
# Uncle Sam's Radio School at Camp Vail

THE FIELD RADIO SET, that goes with the truck carrying radio equipment for a division in the field at Camp Vail, N. J. Five minutes after the truck stops, this set, with a 50-foot pole from which streams an umbrella antenna, is in full operation. Working on a varying wave-length from 500 to 1,200 meters, its signals can be picked up over the entire front and its receiving ability is equal to the best sets made. (By United.)

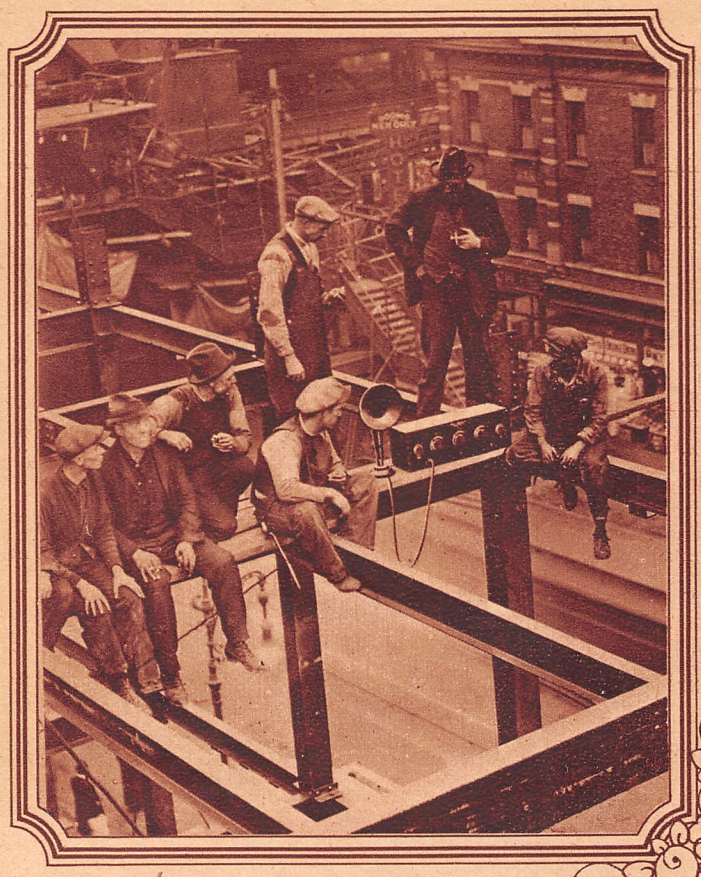
A PORTABLE FIELD SET. This signal corp sergeant saw service in France with the first division and knows a good shell hole when he sees one. It took him but two minutes to erect this batallion radio set; it was carried by two men, and establishes communication with a division set. This is all a part of the day's work at the Signal Corps School for the army at Camp Vail. (By United.)



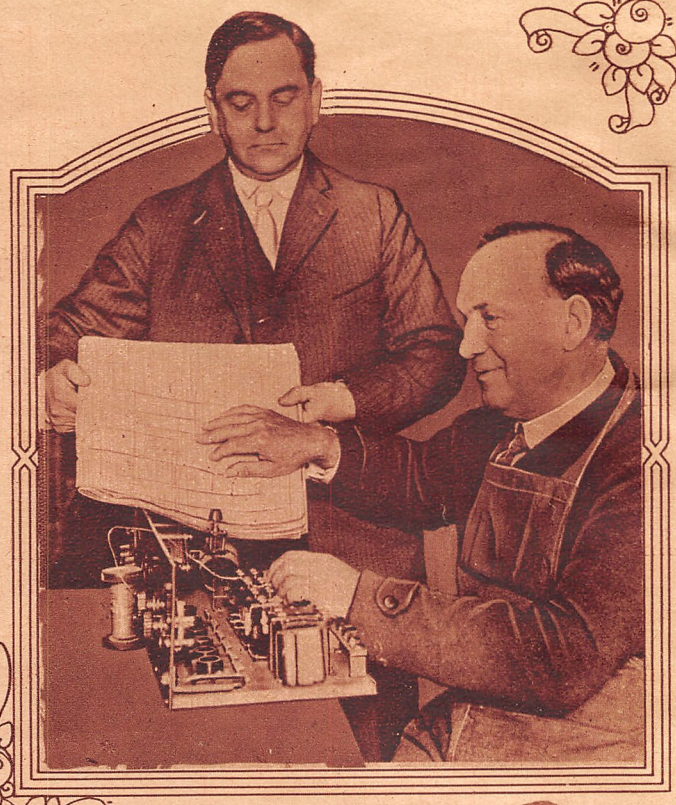
THE U. S. S. MARBLEHEAD. One of the latest additions to the U. S. Navy and one of the fastest destroyers afloat has complete radio equipment. Note the cage antenna strung between the cross arms on the forward and aft masts. © Kadel & Herbert.



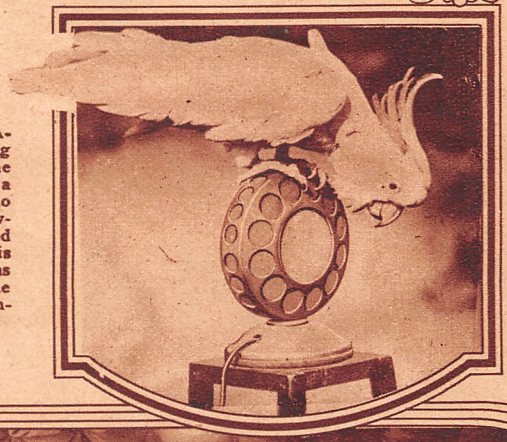
UNCLE SAM'S OFFICERS LEARN RADIO. Camp Vail, New Jersey, may aptly be called the signal corps headquarters for more signal corps officers are gathered there than ever before in any one place. The commissioned and enlisted personnel who are there to learn all the ins and outs of signaling, is about 700. Radio, visual signaling, telephony, telegraphy and methods of training pigeons and messenger dogs, all enter the curriculum. Every student officer, up to and including captains, not only has to be able to build a receiving set, but he also has to know every why and wherefore connected with it. The groups of student officers perform the actual work under the direction of the regular signal officers in indoor classes and outdoors over the reservation. A class of student officers at the code desks is shown in the photo above. A headset for each officer is connected to a central phonograph and records of dots and dashes are run off until the student is proficient at receiving signals. (By United.)



**UP IN THE AIR** with a radio set and all kinds of space between them and the ground, these steel workers enjoy themselves at noon hours by listening to the programs from local stations. Even though surrounded by steel girders, the set operates excellently. © Kadel & Herbert.

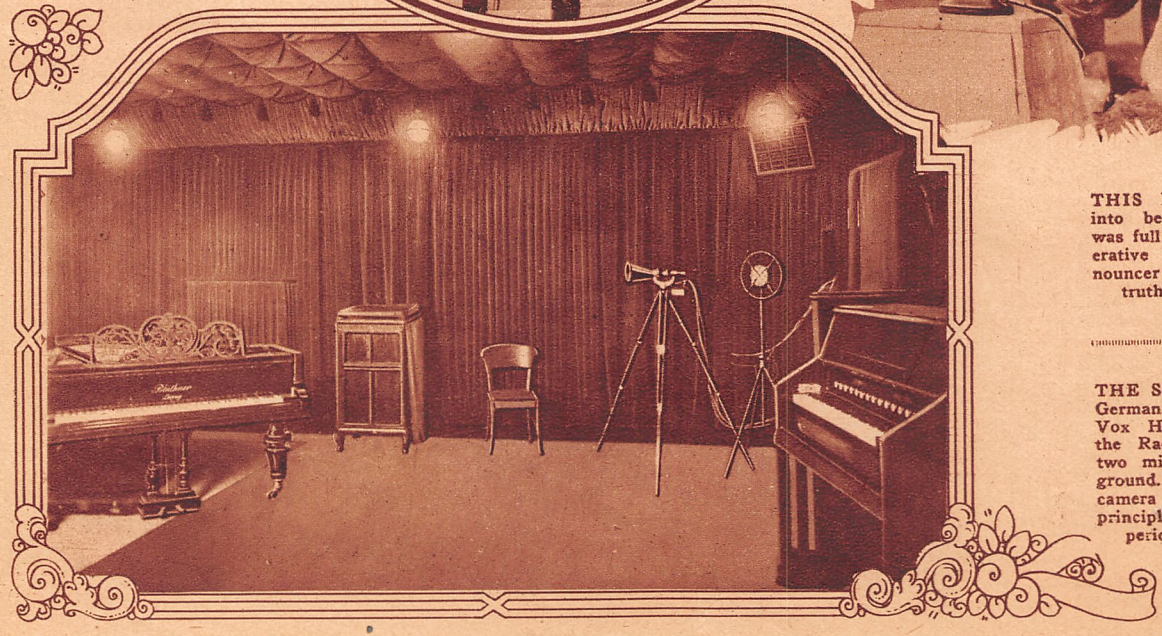


**THOUGH BLIND,** Harry Scott, shown in the photograph above, built his own radio set. He followed a new Braille system blue print of the circuit connections, feeling out each raised line on the print and placing the wire in the set in accordance with the circuit. © Kadel & Herbert.

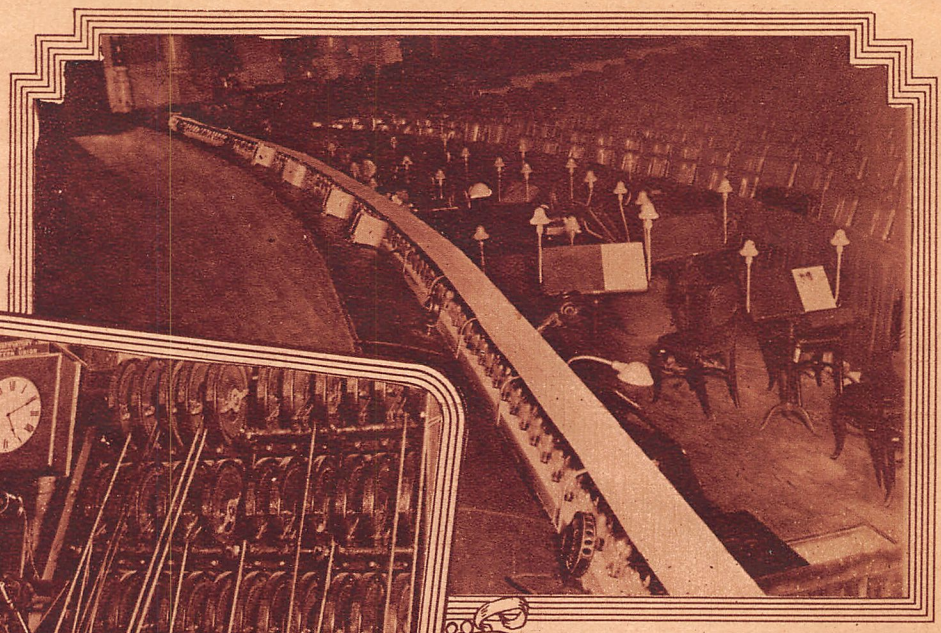


**THIS FRENCH COCKATOO** insisted on remaining perched on the microphone until allowed to render a solo for the listening radio public during a recent novelty program which included a parrot chorus. When his solo was completed he was willing to flutter into the background again. © Underwood & Underwood.

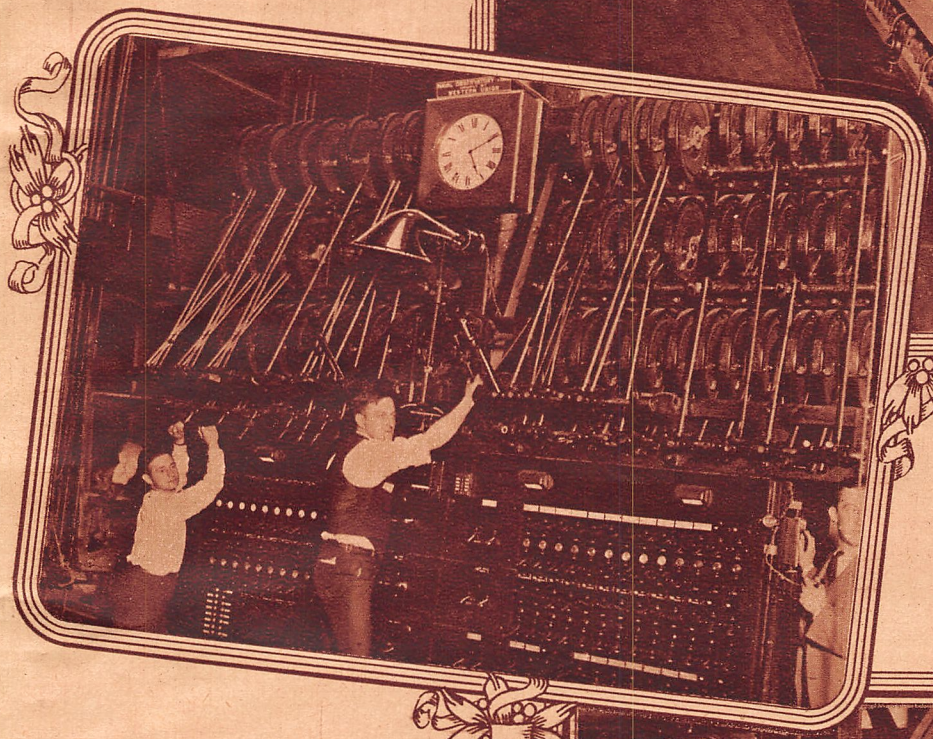
**THIS PIG** fooled radio fans into believing that the ether was full of the squeals of regenerative receivers, until the announcer informed them of the truth. © P & A Photos.



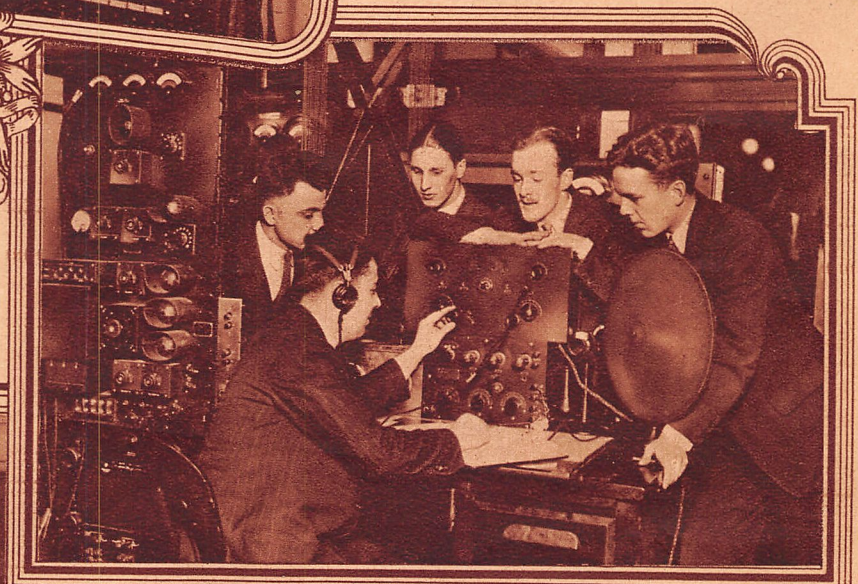
**THE STUDIO** of the powerful German Broadcast Station at Vox Haus, Berlin, known as the Radio Central. Note the two microphones in the background. The one on the camera tripod works on a new principle and has proven superior to the usual type.



**THE HUGE SWITCHBOARD** of the New York Hippodrome, the largest of its kind in the world, which controls all the lights and electrical apparatus. Electrician George Rudolf (center) and his assistants are shown at work. Note the loud speakers at the top of the board.
© Kadel & Herbert.

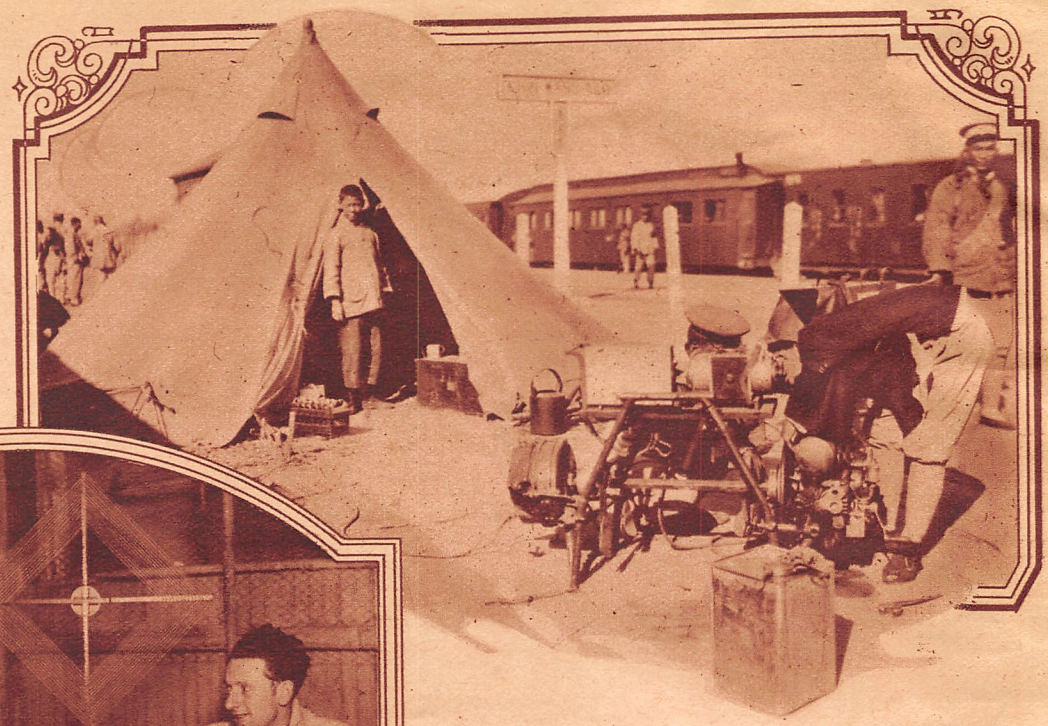


**AT THE NEW YORK HIPPODROME** the operation of the great switchboard, controlling over 6,000 lights and electrical contrivances, was a disturbing problem until a system of microphones and loud speakers was installed. Now the man at the switchboard can hear every word that is spoken on the stage and, having his cues, can control the lights accurately.
© Kadel & Herbert.

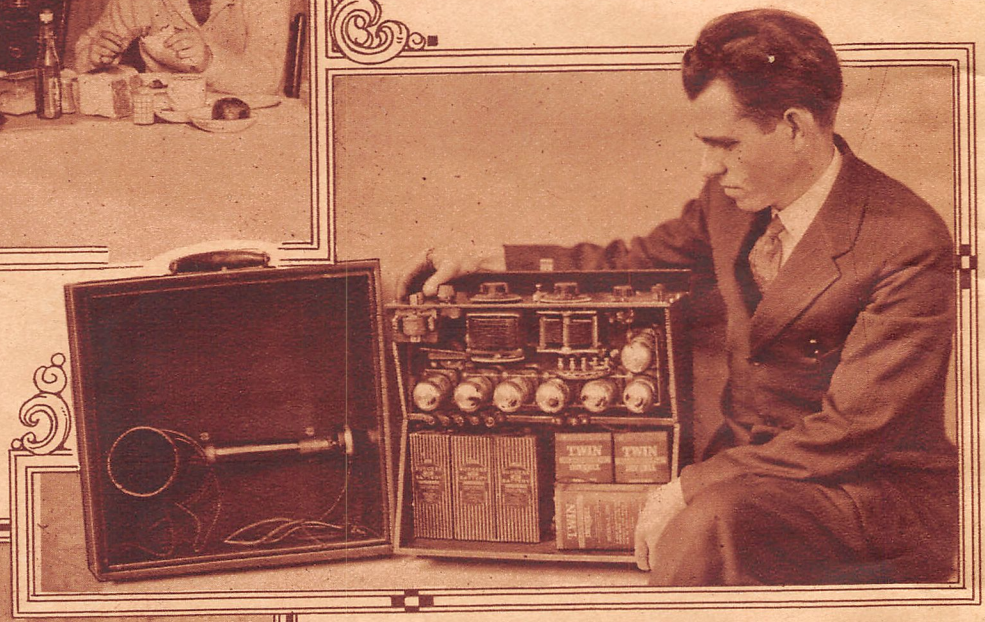


**LISTENING FOR EUROPE** with a special type Super-Heterodyne, using six peanut tubes, at broadcast station WGBS in New York City. Chief Engineer Edward J. Content, is operating the set. The broadcast transmitter of WGBS is seen at the extreme left of the photo.

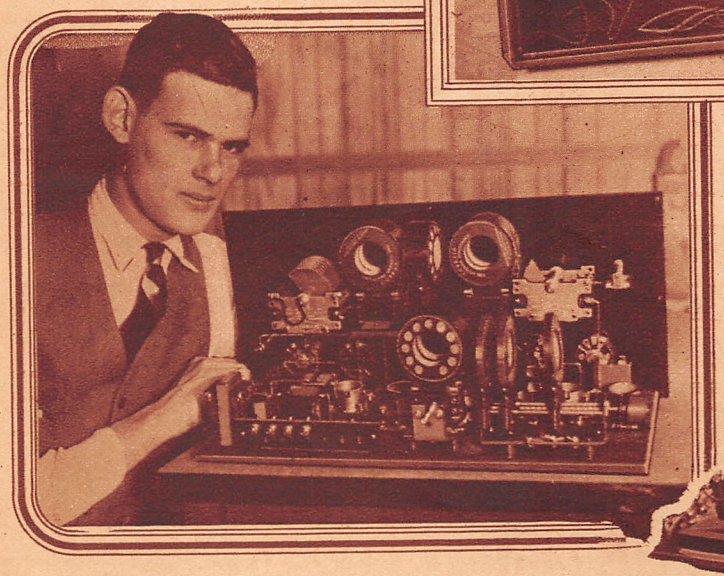
**RADIO ON THE 20TH CENTURY LIMITED.** Election Day, for the first time in history, passengers aboard fast moving trains heard returns by radio when the Twentieth Century Limited, running in six sections between New York and Chicago over the New York Central lines had its observation cars equipped with powerful receiving sets. The United Press Association news bulletins of the count of ballots were heard by a total of 1,000 travelers from 7:15 in the evening until 1 o'clock the next morning, the sets being operated successfully by Western Electric Engineers. The receiving set in the photo is a six tube Super-Heterodyne and is connected to a push-pull audio frequency amplifier, and loud speaker. Note the loop aerial atop the desk.



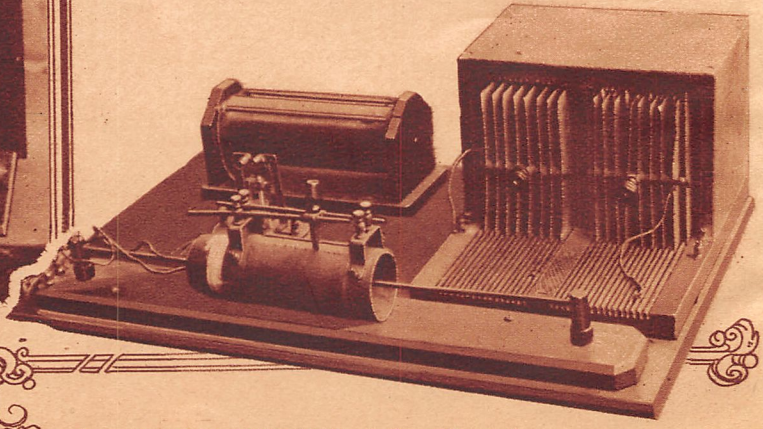
CHINESE NATIONAL TROOPS at the Shanhaikwan front, under command of Marshal Wu Pei Fu, fought against the Manchurian invasion of the Feng-tien Troops to protect the unity of the country and were greatly assisted by the addition of modern portable transmitters and receivers employed to keep in constant touch with headquarters and outposts. The photo at the right shows one of these portable sets in operation at a railway station near the front. © Underwood and Underwood.



THESE SIX DAY BIKE RACERS find pleasant diversion during their few minutes of leisure in listening in on the radio. In the photo above is shown Benesaito (left) and Gastian in rapture over a bedtime story. Can you blame them? (By United.)



PORTABLE SUPER-HETERODYNE. (Above.) Brent Daniel, formerly of the Radio Laboratory of the Bureau of Standards at Washington, with a small portable Super-Heterodyne, his own design. The seven vacuum tubes, batteries, loop antenna, loud speaker and other necessary units are completely self-contained in the carrying case. He has been able to hear Pacific Coast stations from Washington, D. C., with this outfit. © Harris & Ewing.

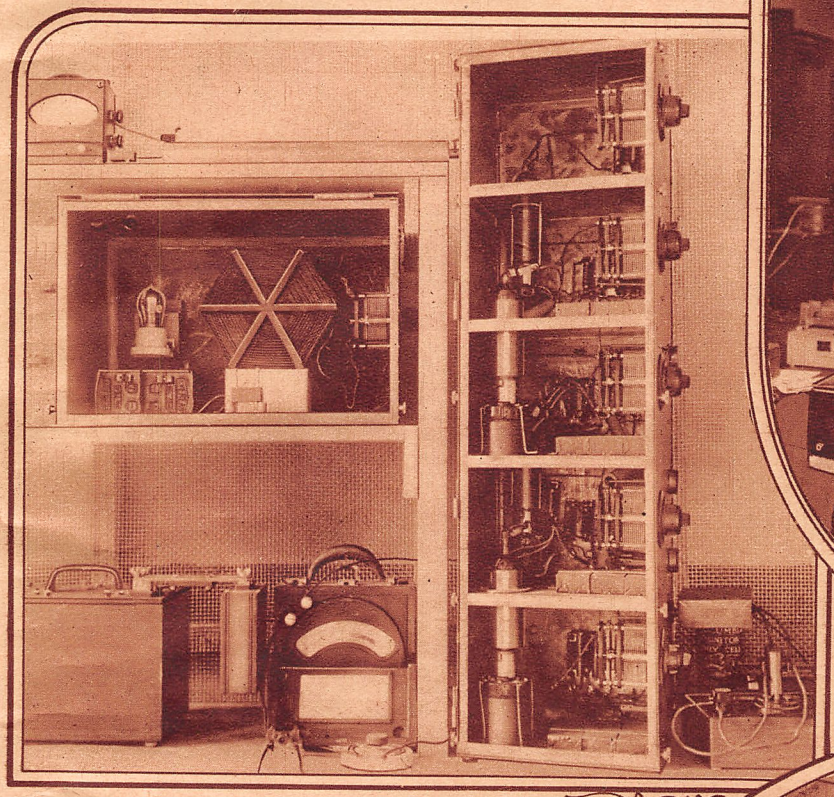


ANOTHER COMPACT "SUPER," the work of M. Michaels. By care in design he has overcome the objections to the long or large panel, making this set about the size of a five tube radio frequency receiver, though the usual eight tubes are employed. © Foto Topics, Inc.

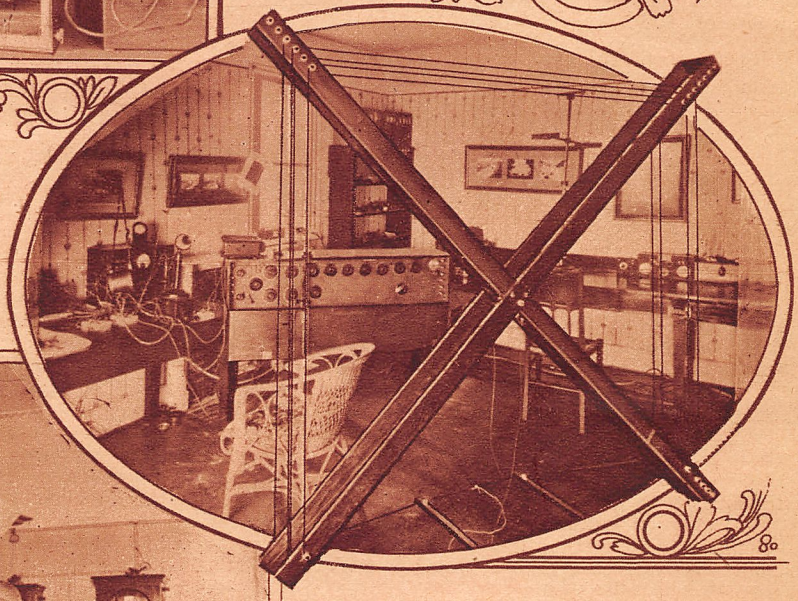
AN ANTIQUE RECEIVER of the vintage of 1900, which was built by H. Cheethan of Boston and exhibited at the Boston Radio Show. It isn't much now, but in those days it was, no doubt, the pride of the city. Note the two sliding plate variable condensers. (By United.)

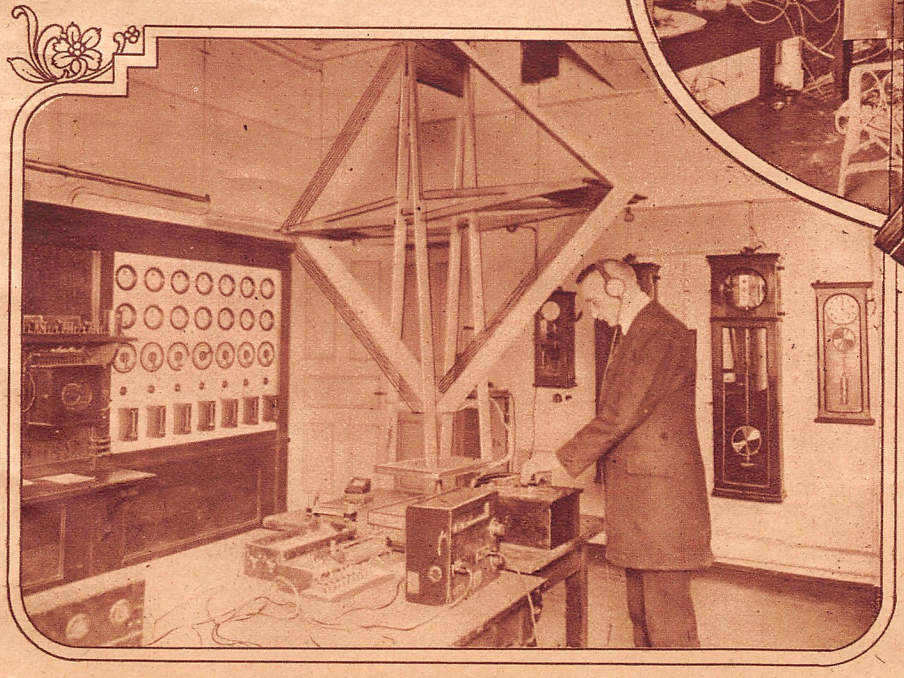
**RADIO CONTROLLED BOAT** (right): J. Elliot Jenkins, the noted young radio expert, shown with the model of his radio controlled steam boat which created a sensation at the Third Annual Chicago Radio Show. The Exposition Directors awarded a silver loving cup to Mr. Jenkins as a token of appreciation of his ultra-valuable contributions to Radio. He exhibited six different devices in the "New Inventions Section." © Cal Harris, Auditorium Hotel, Chicago.

**INCREASES SOUND A MILLION TIMES** (below): This vacuum tube amplifier, jointly developed by Dr. A. W. Hull and Dr. H. H. Williams, in the General Electric Laboratories, increases sound a million fold and makes it possible for scientists to listen to the movement of electrons, the smallest particles of all matter. (By United.)



**SENSITIVE BRITISH SET** (right): Extremely sensitive receiving apparatus installed at the Trafford Park Laboratory near Manchester, England. The six foot loop in the foreground has been in constant use receiving the 94 meter wave of KDKA and the 104 meter wave of WGY. This elaborate outfit is connected by wire to the operating room of the Manchester Station 2AC from where the American programs are re-broadcast for the English listeners. © Foto Topics, Inc

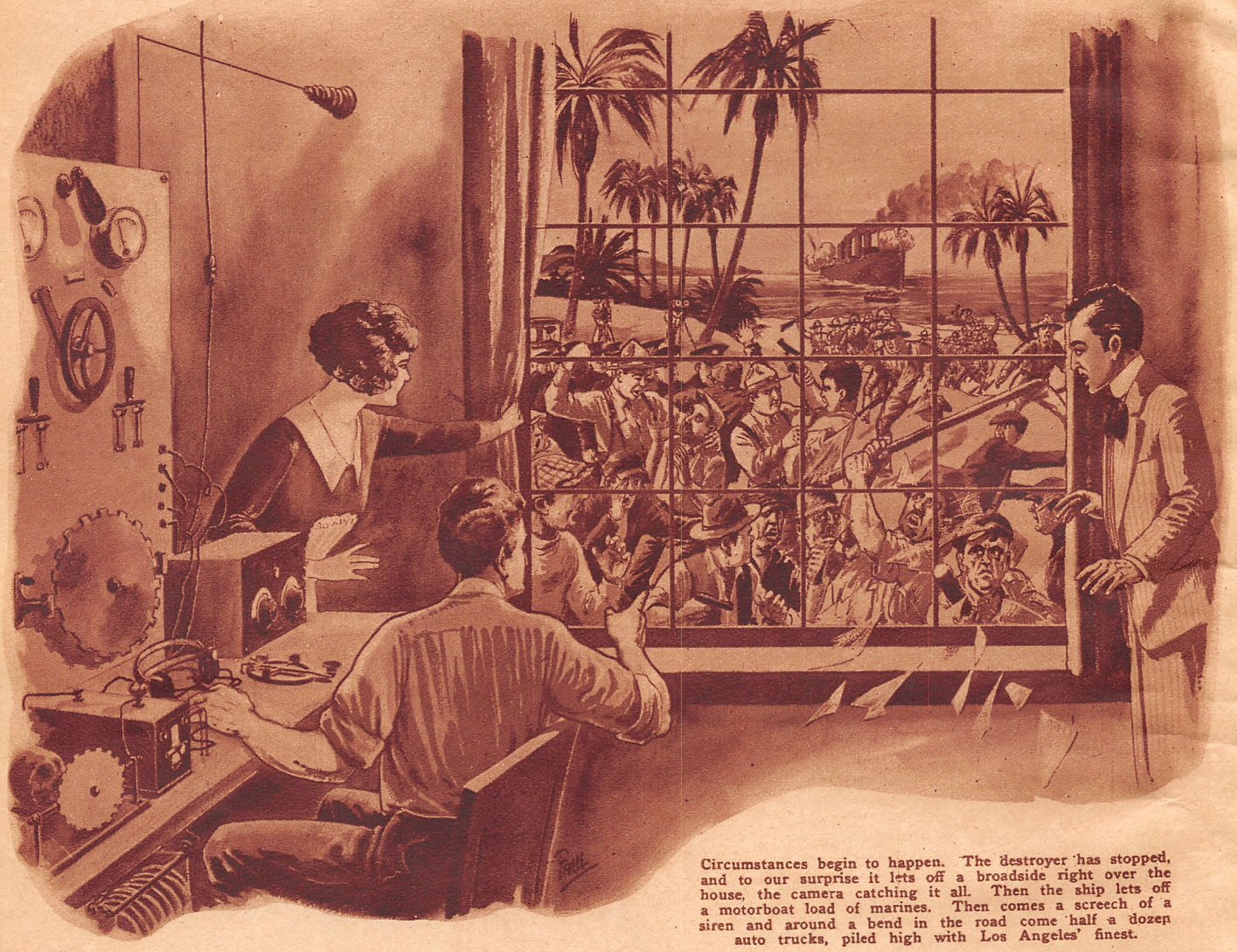




**GERMAN GOVERNMENT BROADCASTS TIME SIGNALS TWICE DAILY OVER RADIO**: The German Government has installed at Hamburg, Germany, facilities for regulating time to a tenth of a second so that it may be broadcast twice daily from the powerful Naval Wireless station. Ships at sea are specially benefited by this service as well as land points within the range of the station. Chronometers together with astronomical observations are the basis for the broadcasting of the signals. The apparatus employed for this purpose is shown in the photo to the left. © Underwood & Underwood.

# The Master Puts One Over

## By ROBERT FRANCIS SMITH



Circumstances begin to happen. The destroyer has stopped, and to our surprise it lets off a broadside right over the house, the camera catching it all. Then the ship lets off a motorboat load of marines. Then comes a screech of a siren and around a bend in the road come half a dozen auto trucks, piled high with Los Angeles' finest.

I NEVER believed much in Santa Claus except once when my crystal set got Schenectady on the bed spring of a third-rate hotel in Calgary, Canada; all said and done, I'm a pretty sane guy, unless somebody hollers "static!" Just to be formal, I'm old man Hammerstein's little boy Joe, no kiddin', and the feminine accompaniment is Doris, whose presence was made legal by a half pint of Scotch, a full night of moon and a minister with insomnia. Professionally, we're dancers in the two-a-day three-on-Sundays,—but there, I ain't supposed to talk shop.

It's Christmas week, we're in Los Angeles, and getting paid for it, which always tunes Doris in to the point of least persistence. Me, I'm happy too, because Pacific coast air is noted for radio work and my six-tube suitcase set is strutting its stuff like a darky on the levee. It's Monday night after the show and we're in our room at the hotel. The critics was nice to us, the audience was better, and San Francisco is coming in like the tide. Everything's sweet. In fact, things is so sweet they can't help but ferment, and pretty soon they does.

"Joe, dear," calls the decrement, "can you change a twenty dollar bill?"

"Can I what a what?" I comes back, cheerful. "Sweetheart, I couldn't alter a dime."

The frau, who is inclined—just inclined—to be close with the jack, announces the evening sermon on thrift.

"Broke again?" she begins. "What happened to that fifty you palmed offa me this A.M.?"

"Well," I explains, "I saw a sale on vacuum tubes in a store down on Hill Street, and of course—"

"Of course!" bites the reason why one man can't leave home. "Of course you hadda go in and buy out the joint."

I smiles meekly. "No, dear," I coos, "the place was closed, so I lost the dough in a crap game back of the Ambassador Hotel."

"Ain't you cute, tho!" snaps Doris. "Cut in another tube, your song's fading."

My fitting retort is QRM'd by the telephone. Doris answers it.

"Send him right up," she says, and actually smiles at me, her hubby!

"Guess who it is," she invites.

"Somebody I owe money to," I replies, playing safe.

"Don't be redic," admonishes the dear thing. "It's Jerry Lawson!"

I jumps to my feet. "The Master?"

"No one else but!"

"Choking choke coils!" I exclaims. "Whadda ye know about that?"

The bankroll watchdog makes a dive for my dressing gown. "Put this on, Joe," she orders. "Jerry ain't used to seeing you *en deshabillé*."

"Cut out the Russian," I advises. "Here he is now."

I opens the portal and in steps Mister Gerard Lawson, of Brightmere-on-the-Deep, Long Island.

"Joe!" he exclaims, gripping my hand. "Doris!" he continues, doing likewise with the wife's proffered palm. "It's good to see you again."

"You ain't hurting our eyes none," I tells him. "But how come you're out here?"

"Just for the winter," he explains. "I've been here about three weeks. I just learned that you were in town and made haste to invite you to my house as guests over the holidays."

After three months of hotels, Pullmans and dressing rooms the aspect of a real home brings back the sweetness.

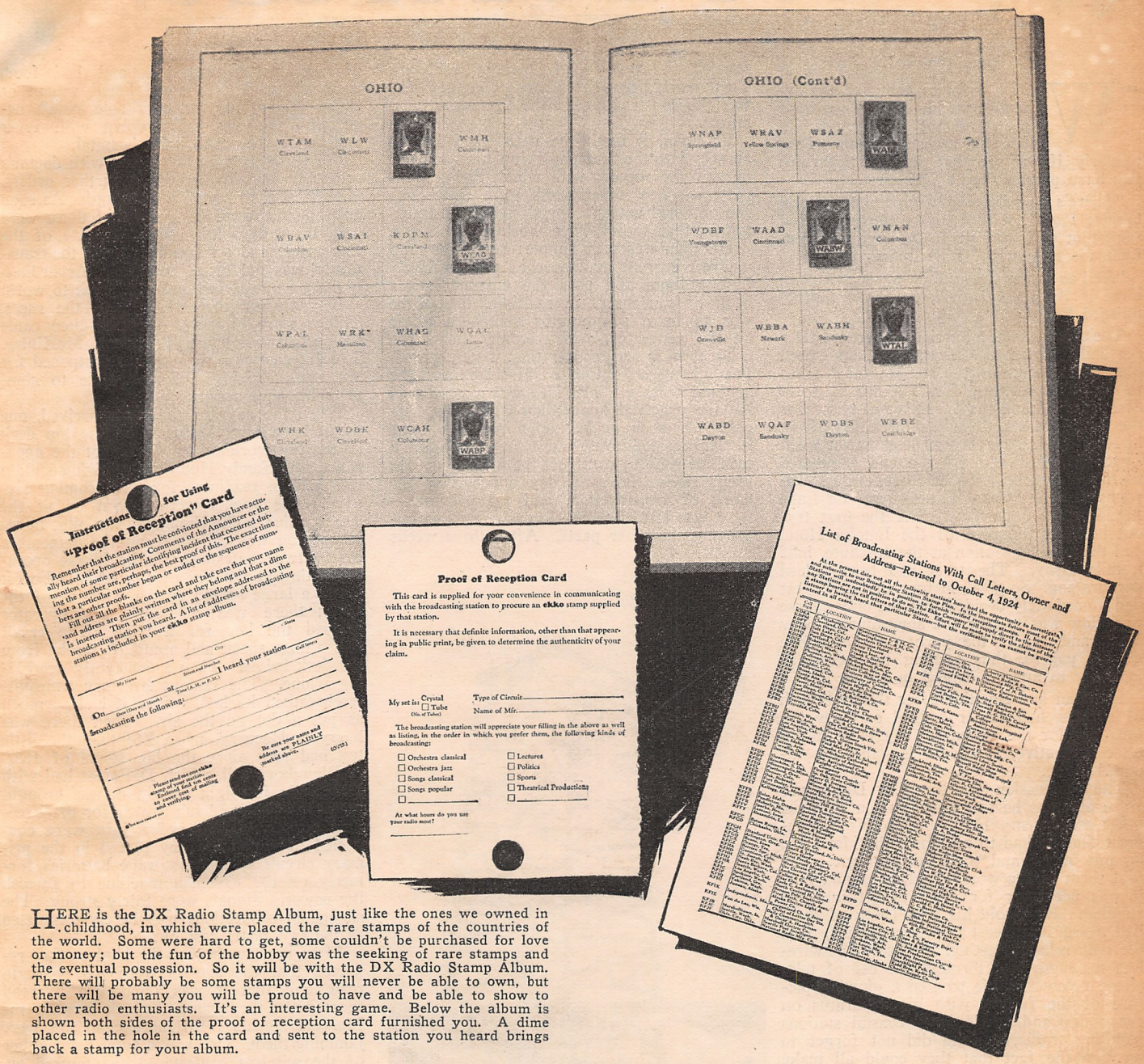
"Jerry, them's kind words," I thanks him. "To be in a home during Christmas week is the best gift an actor could get."

Well, we chins for a while upon numerous subjects. Finally I asks The Master if he's got a laboratory out here.

"Oh, yes," he replies. "And, by the way, I almost forgot to tell you that I'm working as technical director for the filming of

(*Continued on page* 1484)

# The New Radio Stamp Fad




HERE is the DX Radio Stamp Album, just like the ones we owned in childhood, in which were placed the rare stamps of the countries of the world. Some were hard to get, some couldn't be purchased for love or money; but the fun of the hobby was the seeking of rare stamps and the eventual possession. So it will be with the DX Radio Stamp Album. There will probably be some stamps you will never be able to own, but there will be many you will be proud to have and be able to show to other radio enthusiasts. It's an interesting game. Below the album is shown both sides of the proof of reception card furnished you. A dime placed in the hole in the card and sent to the station you heard brings back a stamp for your album.

THE next time you tell how loudly a two thousand-mile station came in and some auditor's lip begins to curl, don't kill him—at least, not until you have shown him the duly authenticated stamp of the broadcast station, proving beyond all doubt that you did bring in the DX. After the skeptic has seen the color of the stamp, you won't have to kill him; you'll have to give him a free dinner some night while he listens to your set and later you will receive a lecture from the little woman for tearing up the desk while searching for a piece of paper on which to copy the hook-up you gave the erstwhile skeptic.

In other words, those who come to scoff will remain to pray.

—But it works the other way, too. Be sure you have the little old stamp before telling how the coast came in so loudly that you had to throw a sofa pillow over the phones to keep them from waking the baby. The Society for the Prevention of Useless Falsehood in Radio will get you if you don't watch out. Some stern visaged individual is liable to step up, throw back his coat and make visible the badge of the society, and upon the authority of same, demand that you immediately show your stamp. And if you have no stamp—well, the only course remaining is to join the Society.

The cause of all this Utopian change in radio? This sudden era of utter truthfulness. Nothing more nor less than the innocent little stamps, shown on the cover of this month's RADIO NEWS. Indeed, this is a majestic discovery, the proprietorship of which St. Peter might well expand his chest for possessing.

A Chicago company has given the idea to the world. It is extremely simple in its analysis. The listener sends for a copy of the stamp album. He receives it together with a map, a call list and a batch of Proof of Reception Cards. These latter are most important. Space on them is provided for listing the numbers of the broadcast programs heard, the time of reception and other marks of proof. The listener mails this card (shown in an illustration on this page) together with a 10 cent piece, to cover mailing costs, to the station. At the station the card is checked against the station log to ascertain the correctness of the reception.

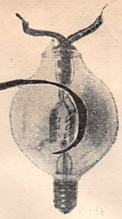
If the numbers and time listed tally with the log, the receptor is immediately mailed a stamp with the station's call letters and design upon it. This is pasted in the album at the proper position and remains as proof eternal of the diligence, patience and skill of the owner of the album.

The book is nothing less than pretentious. The first page of it sets out that "spaces are provided herein for stamps from every broadcast station in the United States, Canada and Alaska." (We cannot help hoping that somebody actually fills all the allotted spaces.)

The stamps are of uniform size, the color and design of each differing, however. The

(*Continued on page* 1550)

# The Life and Work of Lee DeForest



## PART V

"WE'LL have to complete the arrangements at once if we hope to get all the plans made before the race, Freeman. Particularly if we use that sending apparatus *you* have planned," said DeForest.

"There's no particularly great hurry—and besides I am not thoroughly convinced that this stunt will turn out to be anything more than a— a— stunt," replied Smythe.

"And as far as the sending apparatus goes, mine is the most logical, so far outlined," finished Freeman.

The occasion was a hurried conference after the daily papers of Chicago had announced the story concerning the coming yacht races to be held between Sir Thomas Lipton's *Shamrock II* and the *Columbia* as entry for the United States, to be held off Sandy Hook in New York Bay. It was less than a week since DeForest and Smythe had completed the five-mile trial tests, held between a steam yacht and the "Four Mile Course" on Lake Michigan; and ten days after the first try-out between the roof of the Latoka Hotel and the sending station at the Institute, half a mile away. The tests had been indeed encouraging. So good, in fact, that DeForest had immediately decided that the only course to follow was to take the apparatus to New York and report the yacht races for one of the papers, thus gaining the necessary publicity to interest capital in his device.

Freeman and Smythe, after the first flush of success, had rather hedged on their enthusiasm for the system. They were just a bit conservative, as capital is sometimes inclined to be.

The discussion continued. DeForest's voice arose as he saw the situation with the other two men. He knew to his amazement that he had to sell them the idea. He became more and more enthusiastic. He told them of the work of Marconi and how it was necessary for them to get into the running. He retold his idea (both of them had heard it at least two score times) that the only reliable method for receiving wireless messages was through the use of telephone receivers. He painted a glowing picture of the future, with his apparatus on every ship and hundreds of coastal stations handling traffic, and he did not forget to mention the fact that they could all make a million dollars through the idea.

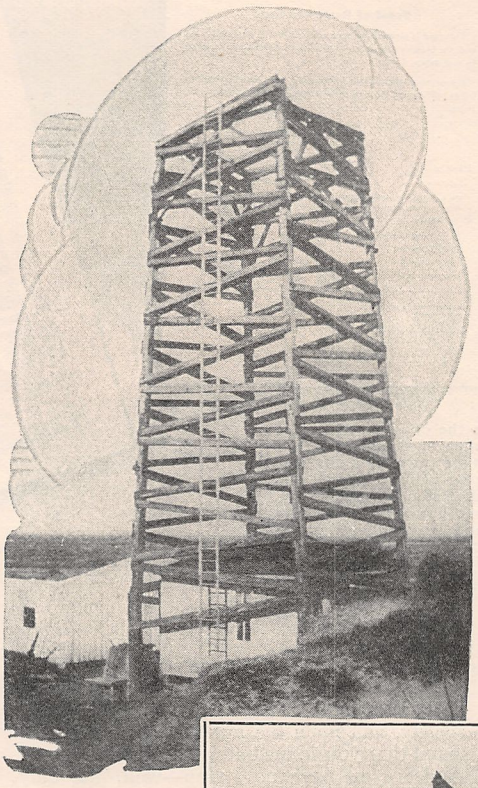
"If you don't want to help me with this I'll get someone else," he finished. They had heard him assert himself in just such a manner several times, and they knew that he meant it, so they agreed with him, having no better course and not wishing to loose his interest.

Accordingly, one week later DeForest, with most of his apparatus, boarded a New York Central day coach in Chicago for New York. Upon arrival he hunted up Stires in Jersey City. As soon as he had time to look around, he met his first disappointment. He found that the Marconi Company had had the same idea and had already contracted with the Associated Press for the concession of reporting the races by wireless.

He'd met such conditions before and so was not disheartened. He simply went to the strongest competitor of the A. P., the Publishers' Press Association, and offered to report the races for them. They, of course, snapped up the offer and agreed to furnish the tug for following the boats. Then work began properly. The first task was the construction of the Freeman transmitter.

Freeman, it might be noted, had horned his way into the "company" in Chicago, when he saw the success with which the preliminary wireless experiments were conducted. He obtained entrance by designing a transmitter, that should have worked but didn't.

His plan was very simple; he would build a direct current generator of comparatively high voltage and pass the current into a bank of condensers in multiple, then there was to be a commutator switching affair on the generator, which would throw the condensers in series after they were charged, thus giving an output of twenty times the original voltage. The idea was a good one, but the practical application was a bit difficult. As soon as he had a place to stow his valise, DeForest went in search of a machine shop to construct the apparatus. He spent twelve hours a day supervising the work of construction, and his evenings—what was left of them—in designing and improving the other parts. After three weeks of this unremitting toil and bad food, snatched quickly in some lunch wagon or cheap restaurant, the inevitable result occurred. He was taken down with fever and had to be sent to the hospital.

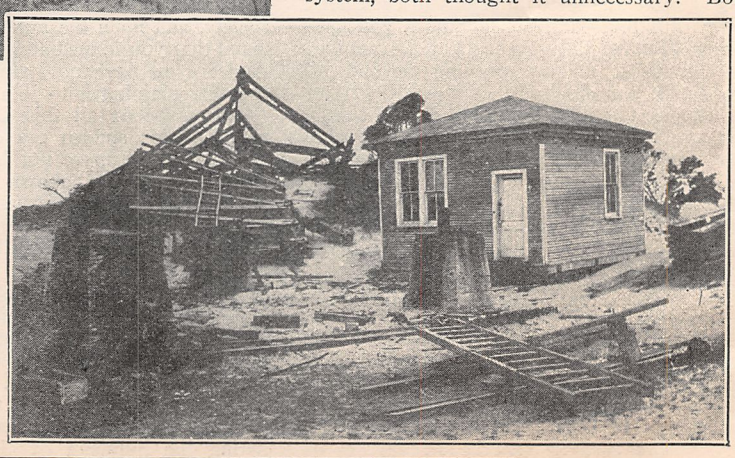


For three days he lay in bed with doctor's orders to remain there until further orders, if he wished to regain his strength. As soon as his mind cleared he knew that there were only three days left before the day of the races, and he also remembered that the transmitter was not nearly finished. Accordingly, he got out of bed and went back to work.

It was only three days until the races. Things were in great disorder—then came the assassination of President McKinley. The International regatta was postponed for six weeks, giving DeForest time to complete his equipment.

When the day for the races arrived, one might have seen DeForest on the top deck of the tug working desperately at the apparatus. At Sandy Hook the receiving station was held in readiness for the incoming signals. The yachts were drawn up at the starting line. The skipper in the pilot house of the tug was calling down the manœuvre of the two contestants to the Morse operator sitting at the key of the set. DeForest threw a large switch on the left side of the table; there was a hum. The operator pressed the key for a trial. The result was a huge spark and a curl of smoke from the deck below. Then a constantly decreasing whine. The famous Freeman transmitter breathed its last, before it had so much as put a dot on the air. Then there was hurry and scurry, more life than the little tug had seen since the big storm of 1887. A Rhumkorf coil, which DeForest had with pessimistic foresight borrowed, was brought up from below and substituted for the Freeman sender. The Leyden jars were connected to it and the key placed in the primary circuit with the storage batteries formerly on the Freeman machine to furnish the power. Signals were fairly strong. The change in connections was barely completed as the two boats cast off.

After the trip began, the land station reported that the signals were too weak to read, and that it was impossible to read them when they came through because the Marconi signals from the second tug were jamming them. This was a point that neither of the wireless contestants had figured on. The rudimentary principles of tuning were of course known. But there being only two companies actively engaged in the use of the system, both thought it unnecessary. Both



One of DeForest's first commercial stations and what happened to it in a high wind. The shack was built directly under the mast. H. P. Vosberg was chief operator.

*Biography recorded by W. B. Arvin of* Radio News, *under the personal direction of Dr. DeForest. Copyright* 1924 *by E. P. Co.*

stations were so hopelessly interfered with that the radio end of the trial was kept up only for the sake of the onlookers, and the press associations used wig-wag code to get their report of the races.

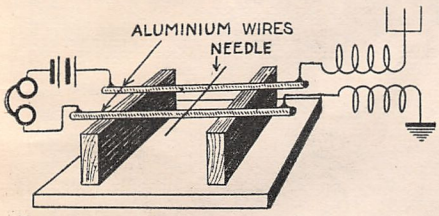
But when the extras came out that afternoon, there was a big headline over the reports of both agencies. It read: "Received by Wireless Telegraphy from tug following the yachts."

The test was a failure for both Marconi and DeForest, but only those inside knew it. The press had as much responsibility as the pioneers; they had announced the feat as a special feature of their service, and so they had to make good.

However DeForest did not know it at the time, the tug docked at Sandy Hook at the completion of the race. When the operator at the land station told him that the signals had faded and disappeared shortly after the boats started, he had to have a chair for support.

Day afer day, throughout the regatta, the trials were continued. The results were but little better.

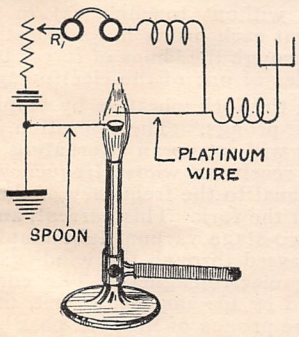
He felt the failure greatly. He had not




One of the early detectors used. It consisted of roughed aluminum wires spanned by a needle.

thoroughly recovered from the fever, which threatened to turn to typhoid at the time, so he accepted the invitation to accompany Barbour to a shack at Rockaway Beach for a much needed vacation. Two weeks of nothing but sleep and rest did him a great deal of good and incidentally gave him back his original enthusiasm for work.

At the completion of the Rockaway visit, he returned to New Haven and his family for a short visit. Back at the old college home, he began haunting all the nooks and

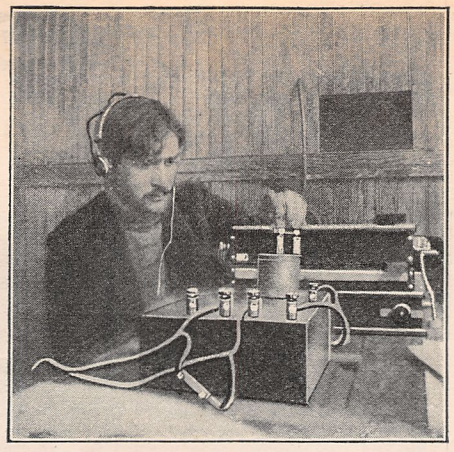



The first "audion." The spoon contained sodium salt and a platinum wire made the plate.

scenes, which had so filled his leisure hours while at school. The lake, the old fence and the campus buildings. He revelled in them all. It was the first vacation he had had since leaving the university.

When he returned to New York early in November, 1901, he was in a mood for work and delved into it with more than his usual zeal. The first question, of course, was to raise capital with which to carry on the business of the newly formed American Wireless Telegraph Company. Smythe and Freeman had long before gone their limit and returned to Chicago.

Following the natural course, he took the clippings of the papers telling of his work in Chicago and the transmission of the Yacht Race signals, and started a pilgrimage for capital. Before he was finished he knew every door man and office boy in Wall



An old time wireless operator, Mr. R. W. Vosberg at one of the early DeForest installations.

Street. A short time showed him that the staid and established men were not the proper financiers to handle such a young and untried project. Twenty-five of them in all he tried before he learned the lesson.

Through an old college acquaintance he had met one Seidler, when he first arrived from Chicago. Mr. Seidler had a little spare money, which he was seeking to invest. DeForest spent about four hours in his office explaining in detail first the scope of wireless and then in telling him why the DeForest system was superior to the Marconi. The result was one thousand dollars in the American Wireless Telegraph Company's treasury. With this sum the Yacht Race equipment had been financed.

This money had all been spent. A few hundred dollars were finally scraped together. DeForest had already seen the difficulties to be encountered in using a spark coil for transmission. Now he immediately began working out the details for a machine using alternating current. He forthwith ordered a transformer and a motor generator. A scientific instrument company furnished the Leyden jars, which were used as transmitting condensers. A trial station was first established in Jersey City.

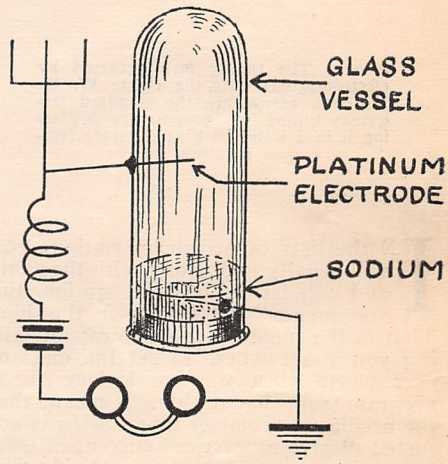
This was the first transmitter to use alternating current as a supply. As in many other cases, the idea had been slumbering in the back of his mind for a long time, only awaiting, the check of some kind-hearted capitalist to put up the necessary money for the apparatus. Even at that time he planned to develop the idea into wireless telephony, as soon as the new promoters raised enough money to afford him the necessary implements.

The important point about this is that the original entries in his note books looking toward a wireless telephone are under date of August 21, 1900. At that time he wrote:

"Hints for wireless telephony, sending end."

However, these ideas had to wait for completion for some years on account of the small calibre of the fiscal agent in charge of the business end of the company.

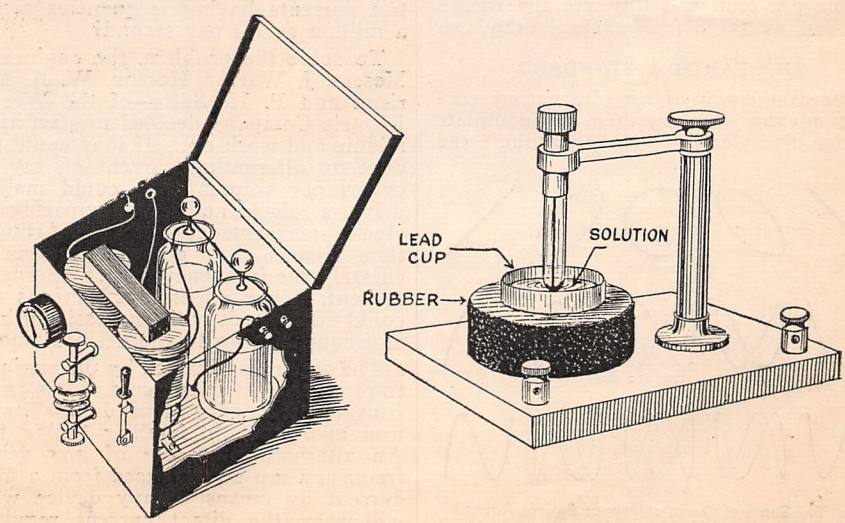
This same fiscal agent was a constant source of trouble to the Technical director of the company. After several conferences in which it was found impossible to raise any more money, a new system had to be tried. It was suggested that some first class promoters should take up the sale of the company's stock and try to raise the money from the public at large, instead of continuing the attempts at finding some one or a dozen men to back it. Another advantage lay here also. Freeman, since his handiwork, in the form of the sender, had refused to function, began to make a great deal of trouble for the management of the company. Each time some prospective investor would become interested in taking part of the stock, he would write immediately, saying that the terms of the proposed sale were not sufficiently good, thus stopping the sale. By the time Freeman reconciled to the transaction the result was usually that the prospective buyer declined to have anything further to do with the company.




The second step in the evolution of the audion showing the early principles.

Matters came to such an awkward pass that DeForest was driven to write:

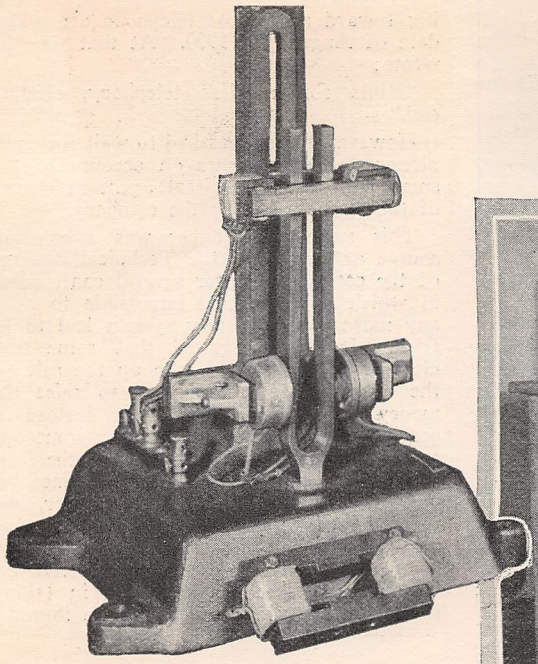
(*Continued on page* 1551)

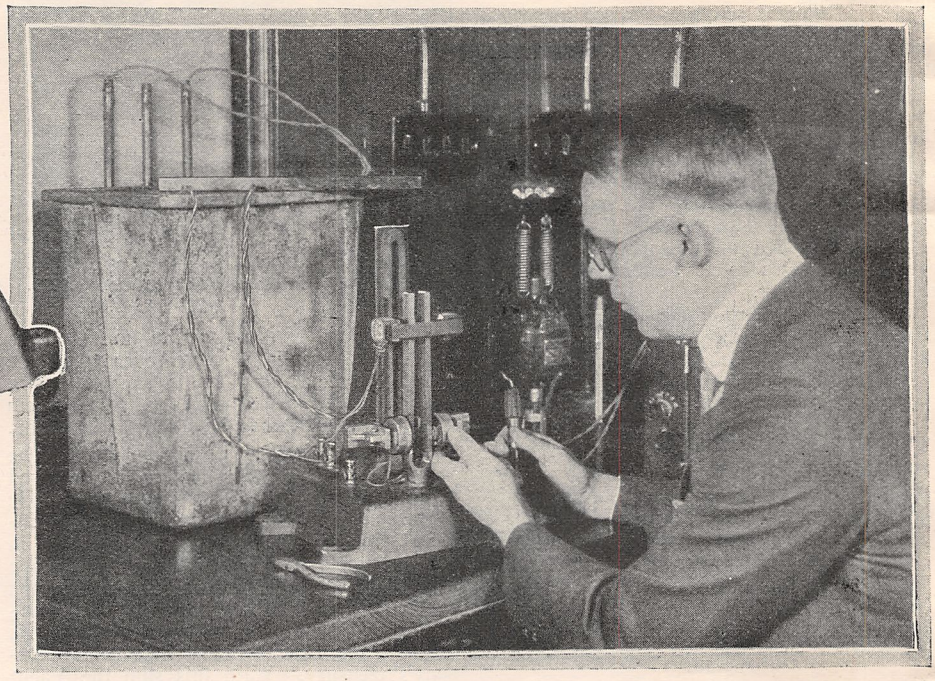



The first transmitter in commercial form to use alternating current is shown at the left. The improved electrolytic detector is pictured at the right.

# How Earth's Rotation

By PAUL B.





Above: The tuning fork actuated by electromagnets. At the right: W. H. Morrison assembling the standard frequency tuning fork, preparatory to placing it in a water bath at constant temperature.

IN the lists of broadcast stations you will usually find, along with the name and call letters of each station, the statement "(600 k.c.)" or the like. That is the most up-to-date way of telling you about where to set the dials of your tuner, when you are looking for a program from that station. It means that the oscillator circuit of that station is adjusted to give a "carrier" current of 600,000 cycles per second. If you divide that figure into 300,000,000, you will get the wave-lengths in meters, i. e., 500. With broadcast stations so numerous, it is essential that their wave-lengths, or carrier frequencies, be set close together, and this in turn means accurate adjustment to prevent overlapping of programs. It is considered good operation if a station maintains its frequency within 2,000 cycles of the assigned value, which is roughly one-third of one per cent. Engineers of the Bell System have, however, worked out methods of measurement, which are accurate to within 1/400th of one per cent. and they use the earth's rotation as their fundamental standard.

### THE EARTH A STANDARD

The frequency of an alternating current means the number of complete swings the electrons make through the circuit in one second. First the current flows in one direction; then it decreases and stops; then it starts up in the reverse direction, rises to a maximum, decreases and stops. This sequence of operations is called "one cycle" and the number of cycles per second has a very important bearing on the performance of many pieces of apparatus. If the "frequency" is below 16,000 cycles, it is audible when its rate determines the pitch of the note given by a telephone receiver; if it is in the radio range, it determines the response of the tuned circuit in your receiving set. Anywhere in the scale the frequency says whether or not the current will pass through an electric filter. So it is essential in communication engineering, that frequencies be known with extreme accuracy.

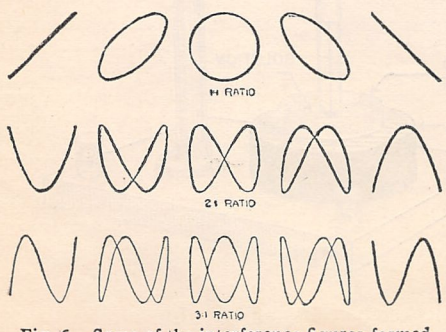



Fig. 6. Some of the interference figures formed by different currents passing through the oscillograph.

The most nearly constant unit of time is the solar day—that is, the time it takes the earth to turn once on its axis. But its frequency is one cycle per 24 hours; how could it be used to check up electric currents having frequencies around a million cycles per second?

To solve the problem, the engineers—Messrs. J. Warren Horton, W. A. Marrison and P. H. Betts—of the Western Electric Company decided to start at the middle and work out. If they could produce an alternating current of, say, 100 cycles per second, they could make it drive a clock and by comparing the clock's performance with the Arlington time signals they could determine accurately the frequency of this alternating current. Then by electrical means they could compare it with successively higher frequencies up to the desired amount.

The apparatus devised by the engineers to produce electric currents of known and constant frequency depends for its action upon the old familiar tuning fork. An alternating current of any desired frequency can be produced from a direct current by means of any device which will vary the direct current regularly. Because of the regularity of its action, a tuning fork was selected for the controlling device.

The tuning fork used has a frequency of 100 cycles a second, and is kept in motion electrically. A high impedance telephone receiver is clamped close to each prong of the fork, but without touching it, so that the motion of the prong will affect the magnetism through the receiver coils. Thus the fork can sing into the electrical system. A pair of electromagnets are fastened near the top of the fork (again without touching it) in such a way that each prong in its vibration will pass through the "lines of force" between the poles of one of the electromagnets.

Start the fork vibrating by tapping one of the prongs. The vibration of the prongs will set up an alternating current in the receivers, whose frequency is exactly equal to the frequency of the vibrations of the fork. This current, amplified by a two-stage vacuum tube amplifier, is then passed through the windings of the driving electromagnets. The current is so timed by the amplifier circuit, that each time the prongs of the fork pass between the poles of the electromagnets they are given a slight magnetic "pull" and so kept in motion as long as desired, by the magnetic effect of an alternating current, whose frequency is determined by the rate of the fork's own vibration. Since none of the apparatus touches the fork, changes in its rate will only be caused

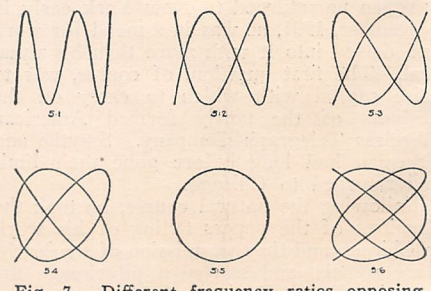



Fig. 7. Different frequency ratios opposing currents give different patterns.

# Sets Radio Frequencies

**FINDLEY**

by changes in temperature or variations in the characteristics of the electric circuit. It is comparatively easy to keep such changes so small, that their effect upon the fork will be negligible.

### MOTOR AND CLOCK

To compare the frequency of the fork with that of the earth's rotation, it is necessary to count the number of cycles of the fork per day. A vacuum tube amplifier is controlled by the driving circuit of the fork, and the output of this amplifier operates a synchronous motor, designed by Mr. Marrison, to rotate once to every five vibrations of the fork. The motor, in turn, through a reduction gear and a commutator, closes a circuit once every 100 cycles, thus driving an electric clock. If the fork makes exactly 100 vibrations every second, this clock will keep correct time. To check its accuracy, the fork-driven clock is compared directly with time signals received from Arlington by radio. Records over a typical month show that the clock gained at the rate of ¼ second per day for the first half of the month. This means that the average frequency of the fork, instead of being exactly 100 cycles, was really 100.0003 cycles. So uniform was the rate of the clock that this frequency of the fork could be relied on to 1 part in 1,000,000. The temperature at which the fork was kept was then readjusted, and the clock lost at the same rate until the end of the month, when it was again in exact synchronism with the U. S. Naval Observatory clock. A gain or loss of a quarter of a second a day means that the clock is accurate to three parts in a million—an accuracy exceeded only by the finest chronometers and astronomical clocks. Remember that mechanical clocks have been developed during several centuries, and you will feel an added respect for American research technique which could bring a new device to such perfection in three years.

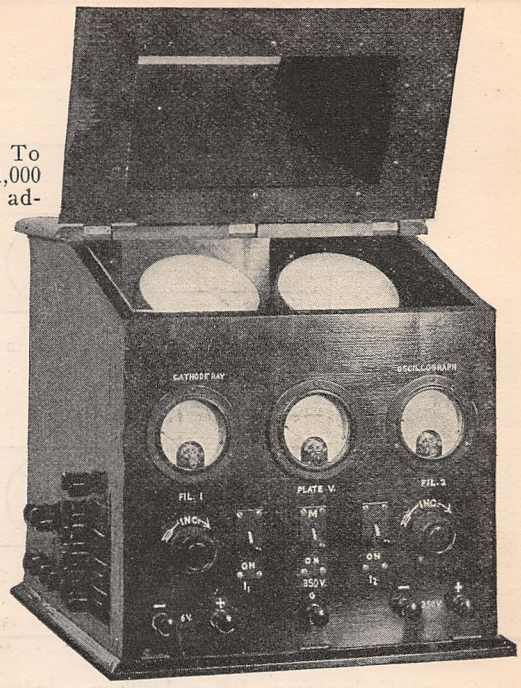
The hundred cycle frequency of the fork was selected with the needs of wire communication in mind. Consequently its frequency is too low for radio measurements. To secure higher frequency, a "harmonic generator" was designed. This is based on the principle that if the energy of any periodic wave is liberated in a small fraction of its cycle, the resultant current will contain a large number of harmonics with frequencies 2, 3, 4 or more times the frequency of the original. The hundred cycle current was brought into such a generator, and the 10th harmonic, or 1,000 cycle current, was selected from the output by a tuned circuit. To make this current easily available, a 1,000 cycle tuning fork was accurately adjusted to this frequency. This fork is driven electrically by the 1,000 cycle current from the harmonic generator and in turn supplied a 1,000 cycle current. Thus the fork acts as a mechanical tuned circuit of extremely high selectivity. By similar methods a 10,000 cycle current may be produced, the mechanical vibrating system in this case being a steel bar.

### ADDITIONAL OSCILLATORS

The arrangement of the apparatus used for stepping up the 1,000 cycle frequency to the desired radio vacuum tube oscillators, designated A, B and C, are employed. These oscillators are designed primarily for frequency stability and accuracy of adjustment. Each oscillator is provided with a precision air condenser controlled by a calibrated micrometer screw. This not only gives a very fine adjustment, but makes it possible to interpolate between settings with considerable accuracy. The oscillator, C, used for radio frequencies, is also equipped with a single plate micrometer condenser of such dimensions, that one turn of the dial corresponds to a capacity variation of 0.1 micromicrofarad. The frequency range covered by each oscillator is indicated on the diagram.

### CATHODE RAY TUBES

The diagram (Fig. 1) shows an oscillograph tube. This works on the cathode ray principle, in which the useful little electron plays a new role. Shot through a tiny nozzle with a velocity of some hundreds of miles a second, these tiny particles crash against the end of the glass tube. But they make no noise; instead they produce a tiny spot of light. The stream can be moved back and forth by the attraction of a varying electrical charge on the plates Px, while another varying charge on coils $C_1$ and $C_2$ will make the stream—and hence the spot at its end

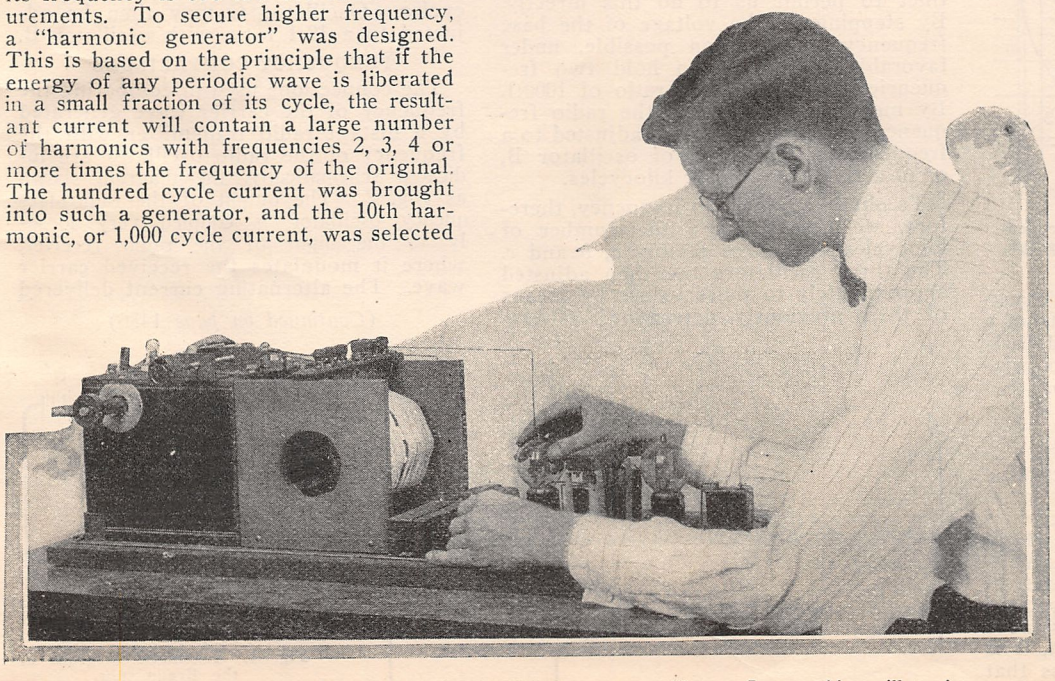



The white disks are the ends of oscillograph tubes on which the frequency patterns appear.

—move up and down. In other words, the electron pencil will write on the end of the tube the story of the varying voltages on the two pairs of plates.

Suppose that alternating voltages be applied to plates Px and coils $C_1$ and $C_2$ at the same time, and that they have the same frequency. If both voltages are zero at the same moment, at that instant the spot of light will be at the center of the chart, Fig. 4. The next instant it will have moved up 1 and over 1, and so on, so that it will shoot back and forth along the line AB. But if Px has two units, the start over $C_1$ and $C_2$, then the spot will start two units further over, and it will trace out the ellipse BB. For a four unit start the path will be CC, and for a six unit start it will be the circle DD. If Px keeps on "getting ahead," the circle will contract to an ellipse, but one whose long axis runs at right angles to BB, CC, etc. This ellipse keeps on contracting until with Px a half cycle ahead of $C_1$ and $C_2$, the path becomes the straight line EE. As Px gains further, EE widens out again first to an ellipse, then to a circle, and this circle contracts to the ellipse, and finally to the line AA, when Px is a whole cycle ahead.

Now suppose that we have on $C_1$ and $C_2$ an alternating voltage that we know is accurately 1,000 cycles. We put on Px a voltage of unknown frequency, but nearly 1,000 cycles. At once we see a path of light from the flying spot. First it is a line, then an ellipse, then a circle, then an ellipse, then a line, etc. Every time it comes back to a line sloping in the same direction, Px has gained (or lost) one cycle on the standard frequency. Let us readjust the capacity or inductance in the circuit of Px until the pattern ceases to change, and remains a circle or line. Then the frequencies of Px and $C_1$ and $C_2$ are exactly the same. Of course, it is difficult to get the pattern absolutely still, but let us say that it goes through its motions once in 100 seconds. During that



P. H. Betts replacing a vacuum tube in the high frequency oscillator. In use, this oscillator is enclosed in a metal box.

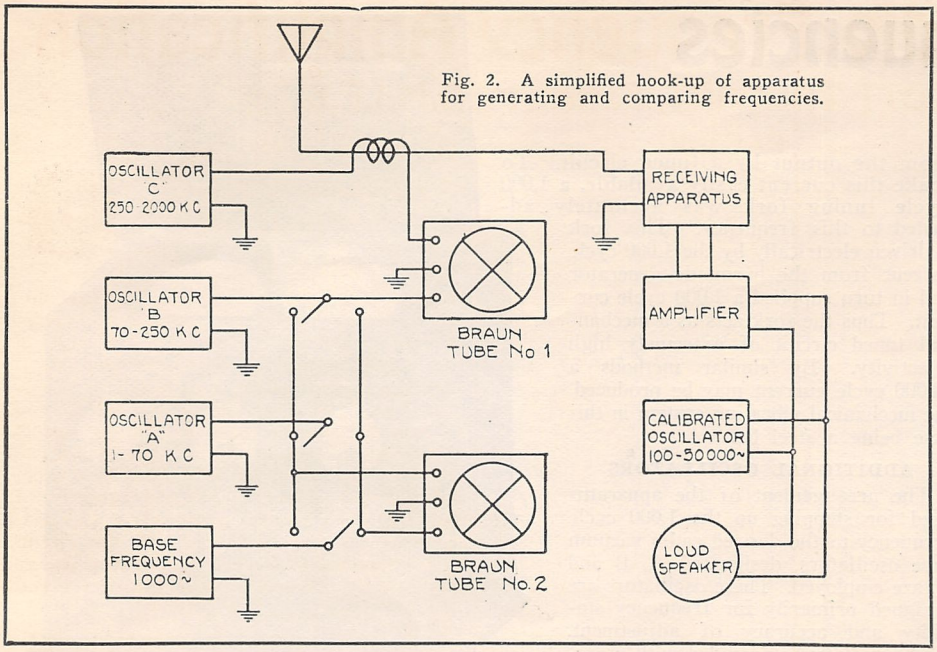



Fig. 2. A simplified hook-up of apparatus for generating and comparing frequencies.

time $C_1$ and $C_2$ has made 100 x 1,000 = 100,000 cycles, and Px has made 100,001 cycles, so the two are alike to within one part in 100,000.

Now suppose the frequency applied to $C_1$ and $C_2$ is three times that of Px, and that they start in phase, that is, with the spot at the center of the diagram (Fig. 5). One instant later Px has moved one unit, but C has dropped three units. Continue to plot points in this way and you will get the curved line FFF. For Px leading C by one unit at the start, the curve becomes the series of loops GGG and for two units HHH. Now if Px is not exactly one-third the frequency

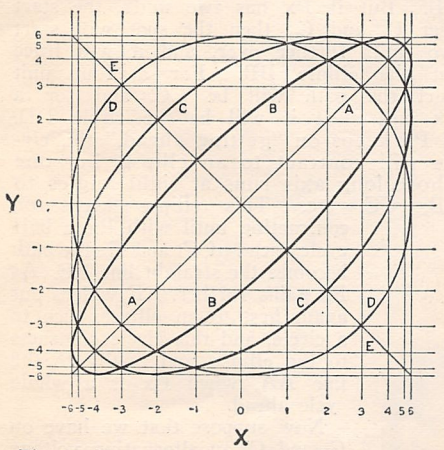



Fig. 4. How two currents of similar frequencies but out of phase effect the oscillograph.

of C, its lead will be constantly changing, and the pattern will change from a single line to a series of loops and back, one full change for every cycle that Px gains or loses over the exact 1:3 ratio. See Fig. 6.)

### PATTERN DESIGNATES RATIO

For other ratios, other characteristic patterns are traced, but when the ratio becomes very large, the pattern becomes too crowded to identify it readily. However, it is possible by using a higher voltage on the lower frequency plates of the oscillograph, to stretch the pattern out at the expense of shoving most of it off the screen. From what is left, it is possible to tell from its steadiness that the two frequencies are an *exact* multiple of each other, and from the capacities and inductance of the circuit one can tell what multiple this is.

The method of adjusting the oscillator C (Fig. 2) to any desired radio frequency is as follows:

The oscillator A is first adjusted to some multiple, *a*, of the one kilocycle base by a direct comparison on Braun tube No. 2. Oscillator B is next compared with oscillator A, on the same oscillograph tube, and adjusted to have *b* times its frequency. Oscillator B is, therefore, generating an alternating current having a frequency of *ab* kilocycles. The Braun tube patterns corresponding to the ratios *a* and *b* are such that the ratios may be absolutely identified by an inspection of the pattern. Having thus adjusted the oscillator B, its frequency is next compared directly with the base by the tube. In this case, however, the pattern contains so many lines that it cannot be identified as having the ratio *ab*. We are, however, interested now in maintaining the oscillator B at an exact multiple of the fork, which is already known, and the pattern is sufficiently distinct to permit us to do this directly. By stepping up the voltage of the base frequency it has been possible, under favorable conditions, to hold two frequencies accurately to a ratio of 1000:1. By means of tube No. 1 the radio frequency oscillator C may be adjusted to a frequency *c* times that of oscillator B, or to a frequency of *abc* kilocycles.

To obtain any desired frequency, therefore, we first separate the number of kilocycles into three factors *a*, *b* and *c*. The three oscillators are then adjusted approximately to these values by means of their previously determined calibrations. For example, on several occasions the frequencies obtained by this method have been compared with those transmitted by the Bureau of Standards. These standard frequencies covered the range from 400 to 1,000 kilocycles at 100 kilocycle intervals. To obtain these frequencies, therefore, we chose $a$=10, $b$=10, and $c$=4, 5, 6, . . . 10.

In some cases it is difficult to factor the numer of kilocycles so as to obtain small integral numbers for *a*, *b*, and *c*. For instance, in the case of 610 kilocycles (492 meters) it is impossible to obtain a factor smaller than 61. We can, however, proceed in this fashion; with the oscillator A set at 10 kilocycles the settings for the oscillator B to give 50, 60, and 70 kilocycles may be determined. Since these settings are obtained on the continuous accurately-graduated scale of a precision condenser, the setting corresponding to 61 kilocycles may be determined by interpolation with considerable accuracy. Oscillator B is calibrated in this manner over its entire range at intervals of 1 kilocycle. By adjusting the capacity of the oscillator to this setting and comparing the frequency directly with that of the base, a moving pattern will be observed on the Braun tube. When this pattern is brought to rest by suitable re-

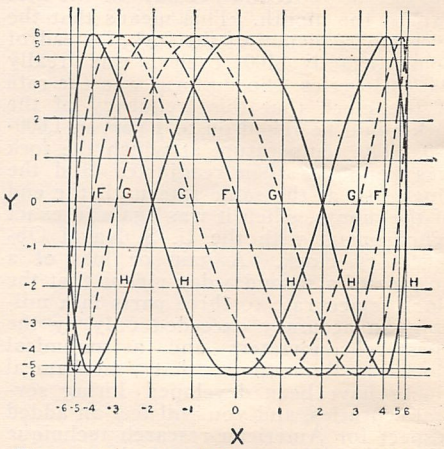



Fig. 5. Here the "Y" current has a frequency three times that of "X". Note the slope of the curves.

adjustment of the oscillator B, we know that its frequency is accurately 61 kilocycles. Oscillator C may then be adjusted to a 10:1 ratio with oscillator B.

### FREQUENCY COMPARISONS

The connections used in comparing the frequency of the carrier wave generated by a distant radio transmitter with the frequency of the radio oscillator are indicated schematically, the diagram shown as Fig. 2. The output of the radio frequency oscillator is coupled very loosely to the input of the radio receiver, where it modulates the received carrier wave. The alternating current delivered

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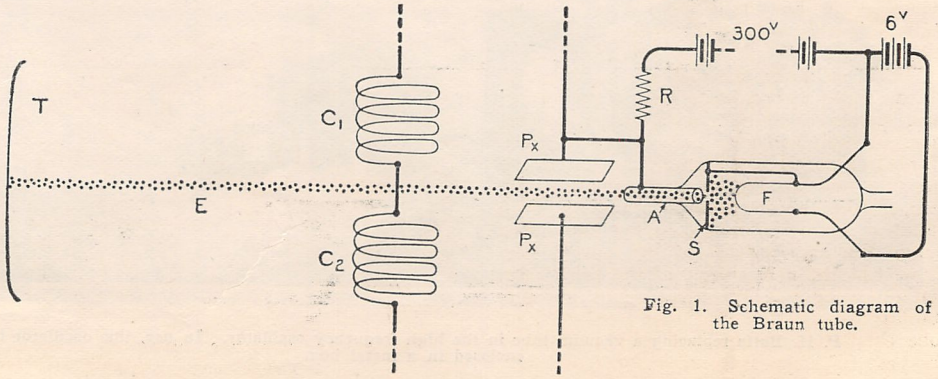


Fig. 1. Schematic diagram of the Braun tube.

# Multi-Stage Radio Frequency Amplification

By JOHN SCOTT-TAGGART, F. Inst. P., A.M.I.E.E.

## PART IV

*Of particular interest in this installment of the series of articles is the T.A.T. system of radio frequency amplification published here for the first time. This circuit opens up a new field for those interested in long distance reception.*

EVERY experimenter has dreamed of the ultimate set with stage after stage of radio frequency amplification. He has been forced, however, through the defects of the usual circuits, to forego his desire because of the tendency to oscillate found when two or more tuned stages are employed. After experimenting for some time the author has found what seems to be a likely solution.

Those who followed the previous series of articles dealing with multi-stage radio frequency amplification have undoubtedly noted that oscillation in these stages is the bugbear of every constructor who attempts to use it, and at the same time desires to get full efficiency from the tubes employed.

As was pointed out in the previous articles it was practically impossible to tune both the plate and grid circuits of radio frequency stages since even the minutest coupling between them produced oscillation and the capacity between the elements of the tubes is usually sufficient cause. Many experimenters have attempted to gain multi-stage radio frequency amplification by tuning the grid circuit and passing the plate output

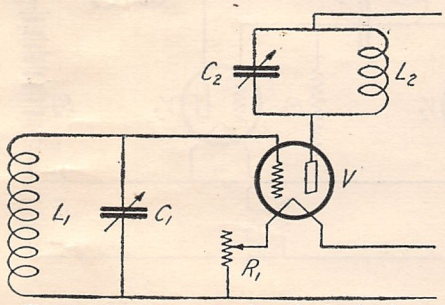


Fig. 1. Tuned plate and grid circuits have an inherent tendency towards self-oscillation.

through an aperiodic coil coupled to the input side of the following tube. Such instances have usually resulted very badly, since the coupling between the output and grid circuits is usually close enough for the latter to pass some if its tuned characteristics back to the plate circuit through inductive and capacitive coupling, thus leaving the circuit, in effect, as bad as if the plate circuit is actually tuned.

Shielding between units has been resorted to in many cases with very good effects. However, it is utterly impossible to depend on the effectiveness of this method for more than three stages.

The resistance coupling, of course, is one solution, but here as with transformers, efficiency is so low as compared with other methods that many experimenters refuse to employ it.

The T. A. T. system makes a combination of the tuned circuit method and the resistance coupled method which has the advantages of both and very few if any of their disadvantages. By tuning the grid circuit of one tube and passing its plate output to the grid of the second through a voltage drop obtained by resistance coupling and then tuning the plate circuit of the second tube as well as the grid circuit of the third tube, and repeating the cycle over again, absolute stability of operation and total freedom from tube oscillation is obtained with practically the best efficiency from the tubes employed. Needless to say this is a very exceptional state of affairs in dealing with radio frequency.

In summarizing for the benefit of those

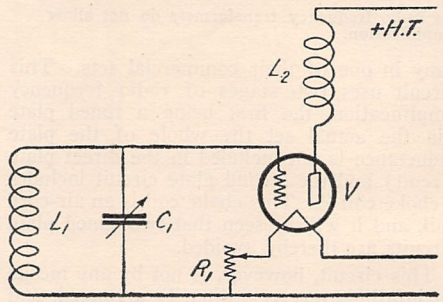


Fig. 2. An aperiodic radio frequency stage which normally will not oscillate.

who did not follow the previous articles, Figs. 1, 2 and 3 will give the reader a fairly clear idea of the questions involved.

Fig. 1 shows a tuned grid circuit $L_1$ $C_1$ and a tuned plate circuit $L_2$ $C_2$. When these


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two circuits are tuned to the same wavelength, the tube will oscillate readily on the slightest provocation, *i.e.*, when there is the slightest magnetic coupling between $L_2$ and $L_1$ or the slightest capacitive coupling between the two circuits. This capacitive coupling may take effect due to the capacity between $L_2$ and $L_1$, or the capacity inside the tube between the grid and plate. However it takes place, the fact remains that this circuit oscillates very readily, and especially so if the condensers $C_1$ and $C_2$ are kept at low values, which, of course, is desirable if maximum regeneration is required.

In Fig. 2, however, an aperiodic plate coil $L_2$ will prevent the tube oscillating, except in one special circumstance. The coil $L_2$ is not really aperiodic, but is shunted by a capacity formed of the distributed capacity of the coil, the capacity across plate and filament of the tube, etc., etc. If the circuit $L_1$ $C_1$ happens to be just tuned to what we may call the natural wave-length of the coil

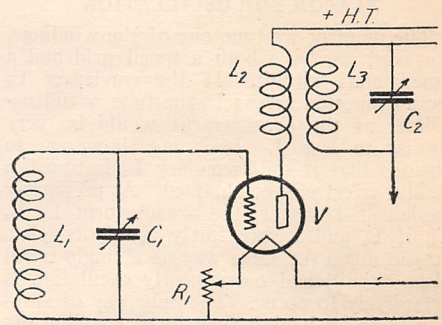



Fig. 3. A tuned R.F. transformer stage which is really equivalent to the Fig. 1. circuit.

$L_2$ and its associated capacities, the tube will oscillate readily. This effect is noticed in ordinary regenerative receivers if too large a plate coil is employed. A 100 or a 150 turn honeycomb coil, for example, will make an otherwise stable broadcast receiver oscillate on the broadcast wave-lengths. Consequently we use a smaller feed-back coil for such work.

Provided the coil does not resonate at the same wave-length as the circuit $L_1$ $C_1$, oscillation will not be experienced with the Fig. 2 circuit.

As regards Fig. 3, it might be thought that because $L_2$ is untuned the tube V will not oscillate. If, however, we connect this circuit and tune $L_3$ $C_2$ to the same wave-length as $L_1$ $C_1$ the chances are that the tube V will burst into oscillation, provided $C_1$ and $C_2$ are kept low. If the transformer $L_2$ $L_3$ is of the aperiodic type, no condenser $C_2$ being employed, then self-oscillation will not take place. But aperiodic transformers of this kind are not much use for broadcast purposes, although they are frequently employed for long wave reception. In those circuits where they are sometimes used it will be

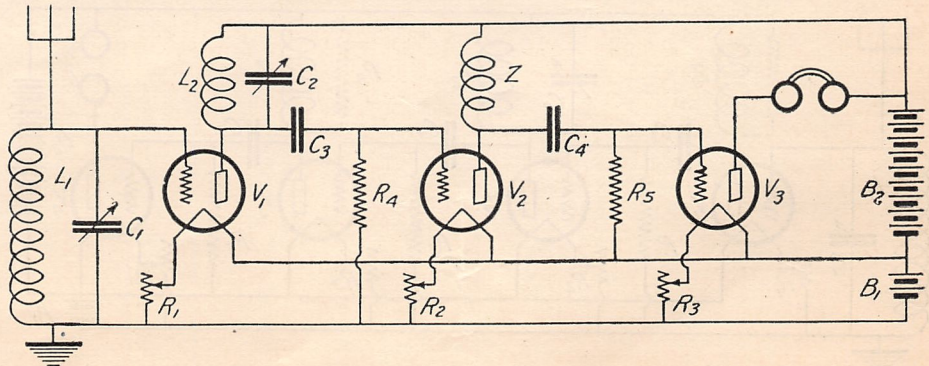



Fig. 4. An interesting circuit of a commercial receiver employing two stages of radio frequency amplification and detector.

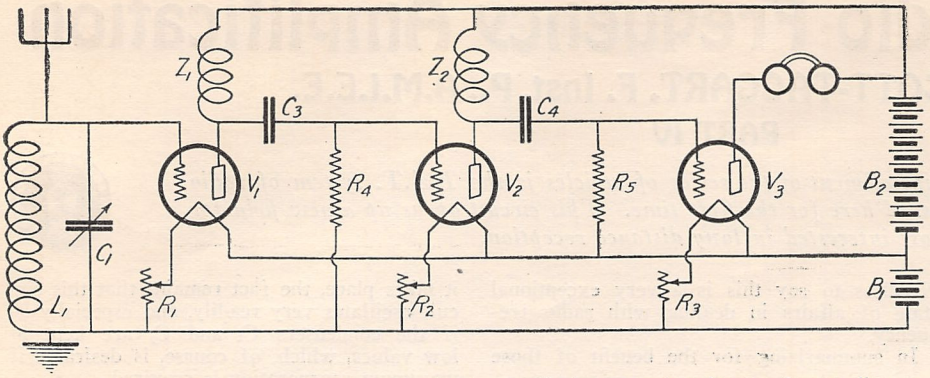



Fig. 5. Two choke coils employed in this circuit as radio frequency transformers do not allow a full degree of amplification.

found that the transformers approximately resonate to the wave-length to be received, in which case we are not really dealing with an aperiodic transformer, but a more or less tuned one, the tuning, however, being fixed for approximately a certain wave-length by using suitably sized coils.

### REASON FOR OSCILLATION

The moment we tune one of the windings, however, we have both a tuned grid and a tuned plate circuit. If the condenser $C_2$ were connected across $L_2$ the tube would oscillate, as the arrangement would be very similar to Fig. 1. It is not, however, so obvious that if the secondary $L_3$ is tuned, a similar effect will be obtained. As previously explained, however, the arrangement $L_2$ $L_3$ $C_2$, if $L_2$ and $L_3$ are fairly tightly coupled, acts in much the same way as a single tuned plate circuit, and consequently oscillation is very likely to occur. The only way of stopping it is by having very loose coupling between $L_2$ and $L_3$.

### THE T.A.T. SYSTEM

The T.A.T. system is really a compromise between aperiodic radio frequency amplification and the method using tuned circuits. Aperiodic methods are, of course, well known, and consist of using a choke coil (air or iron-core), aperiodic transformers, or resistances. All these methods have been used in the past, the latter method being particularly suitable for radio frequency amplification of waves over 1,000 meters in length. Choke coupling has been effectively used for short wave work, because the impedance of a choke coil increases with the frequency. Transformer coupling has been used, but only on much longer wave-lengths, and is generally a poor method of passing on the radio fequency currents.

Tuned methods include tuned plates and tuned transformers in which either the primary or secondary is tuned and sometimes both.

These are the common methods which have been hitherto used.

A method of interest in connection with this article is that illustrated in Fig. 4, which has been used by the Western Electric Company in one of their commercial sets. This circuit uses two stages of radio frequency amplification, the first being a tuned plate (in the actual set the whole of the plate inductance is not included in the direct plate circuit) and the second plate circuit includes a choke coil Z. This choke coil is an air-core coil, and it will be seen that two tuned plate circuits are thereby avoided.

This circuit, however, is not by any means an infallible one as ordinarily arranged, and stabilizing methods are required. In such a circuit, however, the second tube will not tend to oscillate, because the plate circuit of this tube is untuned, although the grid circuit $L_2$ $C_2$ is tuned. I would like to make it quite clear that the circuit $L_2$ $C_2$ is not only the plate circuit of the first tube, but is actually the grid circuit of the second, the top end of the circuit $L_2$ $C_2$ being connected to the positive terminal of the "B" battery, which terminal, however, is at the same *radio frequency* potential as the filament of the second tube. If the first tube is taken out of its socket it will, perhaps, be a little clearer that the circuit $L_2$ $C_2$ is really the grid circuit of the second tube, and that if the first tube is taken out of its socket there is no fear of the second tube oscillating because the circuit $L_2$ $C_2$ and the choke coil Z do not combine to produce an unstable arrangement; the arrangement produced is simply similar to that of Fig. 2.

If, however, we replace the tube in its socket, and look at the circuit $L_1$ $C_1$ and the circuit $L_2$ $C_2$, we will see that both the grid and plate circuits of the first are tuned, a most dangerous combination. If the second tube were switched out, the first tube would still tend to oscillate, for the reasons given, and so the arrangement of Fig. 4 is no important step towards overcoming oscillation in multi-stage radio frequency amplifiers, however practical an arrangement the makers may have made it in their own sets.

Fig. 5, of course, is much more stable because two aperiodic choke coils $Z_1$ and $Z_2$ are now employed, but this circuit is not so efficient as Fig. 4, although more stable. The reason, of course, is that with choke coils no resonating effect is obtained on the desired wave-length, and consequently signal strength and selectivity suffer. The Fig. 4 arrangement, of course, is much better than a single tube using tuned plate coupling, but is not as good as two tuned plates if such circuit could be made stable. It is, therefore, a compromise, and the second tube does not give as great an amplification effect as the first.

In Fig. 5 neither the first nor second tube gives a full degree of radio frequency amplification.

### THE PRINCIPLE

It was by studying the principles involved in these multi-stage radio frequency circuits that I came to the conclusion that a solution of the problem would be to alternate tuned circuits with aperiodic circuits and so prevent any two tuned circuits coming next to each other. This arrangement I have called, for convenience, the T.A.T. system, the letters indicating "tuned, aperiodic, tuned." This implies that the different circuits in the radio frequency amplifier are alternately tuned and aperiodic. If, for example, the first grid circuit is tuned, the plate circuit of that tube will be aperiodic. The next plate circuit will be tuned and the next one aperiodic, and so on, so that a considerable number of stages of radio frequency amplification are possible without it ever happening that both the grid and plate circuits of the same tube are tuned to the same wave-length.

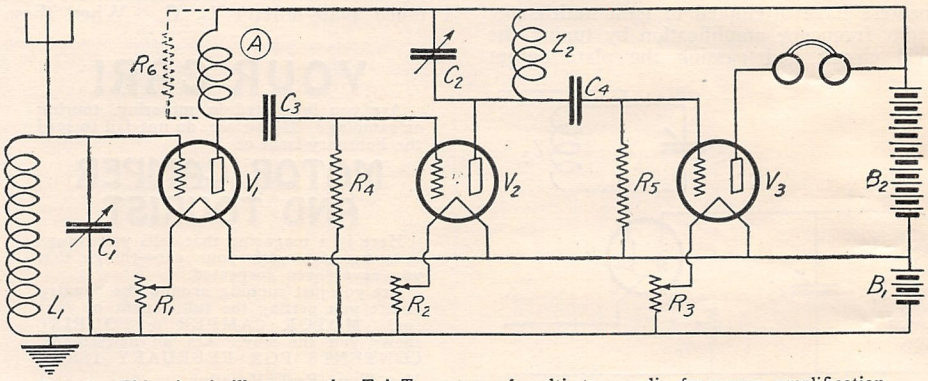



Fig. 6. This circuit illustrates the T.A.T. system of multi-stage radio frequency amplification.

An example of a simple three-valve T.A.T. circuit is shown in Fig. 6. The grid circuit of the first tube, which comprises also the aerial circuit, is $L_1$ $C_1$ (the aerial capacity being regarded as in parallel with $C_1$). The plate circuit of this tube contains a choke coil A, preferably of the air-core type. The radio frequency amplified currents result in varying E.M.F.'s produced across A, and these are communicated to the grid of the second tube. This tube amplifies the radio frequency oscillations which now appear in the tuned plate circuit $L_2$ $C_2$, and the oscillating potentials across this circuit are communicated to the grid of the third tube

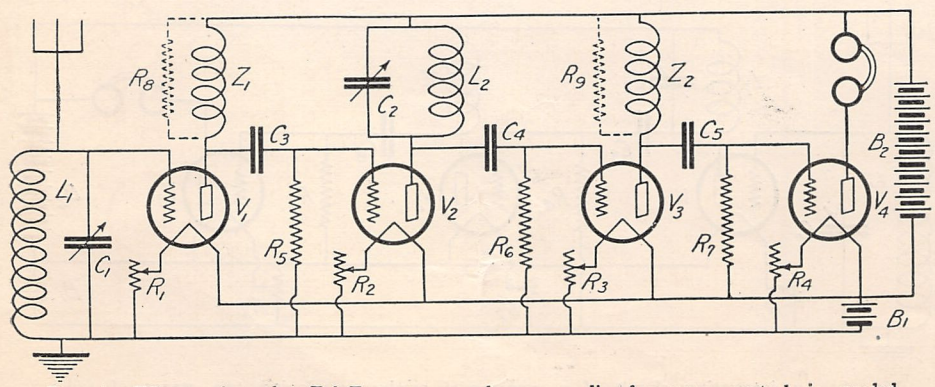



Fig. 7. When using the T.A.T. system, only one radio frequency control is needed for all three R.F. tubes.

which acts as a detector. In this circuit, using two stages of radio frequency amplification, there is not the slightest tendency for $V_1$ or $V_2$ to oscillate.

The tube $V_1$ will not oscillate because the choke coil A, not being resonant to the incoming frequency, will not assist the first tube to oscillate. In other words, the first tube circuit is similar to the basic arrangement of Fig. 2. Exactly the same position with the reverse circuit arises in the second tube if we put a hand over the aerial and grid circuit of the first tube, we will see that the choke coil Z is now the grid circuit of the second tube, and this tube will not oscillate because, although the plate circuit is tuned, the grid circuit is, to all intent and purposes, aperiodic, or, at any rate, not naturally tuned to the same wave-length as the plate circuit. This circuit, of course, is radically different from Fig. 4, because in this latter figure the first tube will tend to oscillate although the second will not. In Fig. 6 neither tube will oscillate because we do not have two tuned circuits in either case. In one case the grid circuit is tuned and the plate circuit is aperiodic, while in the case of the second tube the grid circuit is aperiodic and the plate circuit is tuned.

The second tube acts as a first rate radio frequency amplifier, giving good selectivity, while the first tube does not give selectivity and does not give as good radio frequency amplification as the second. In other words, we have one good radio frequency amplifier and one medium one, but, on the other hand, we have perfect stability, and since we can have half a dozen or more radio frequency tubes arranged in the Fig. 6 style, it will be readily seen that a big total step-up effect is obtainable.

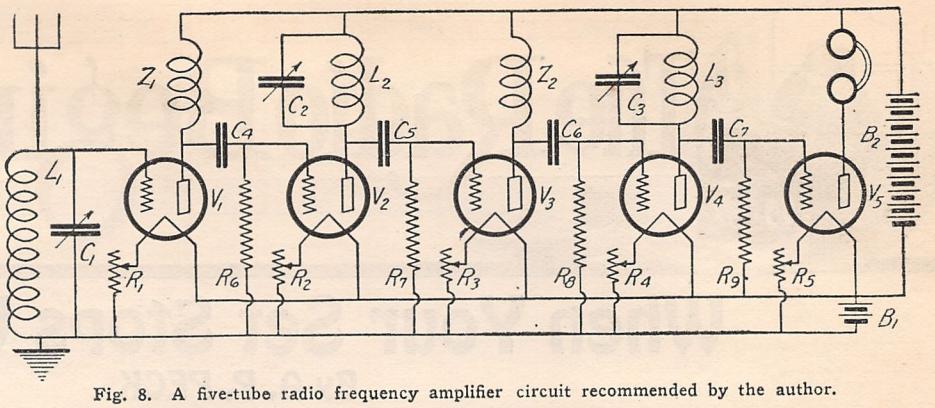



Fig. 8. A five-tube radio frequency amplifier circuit recommended by the author.

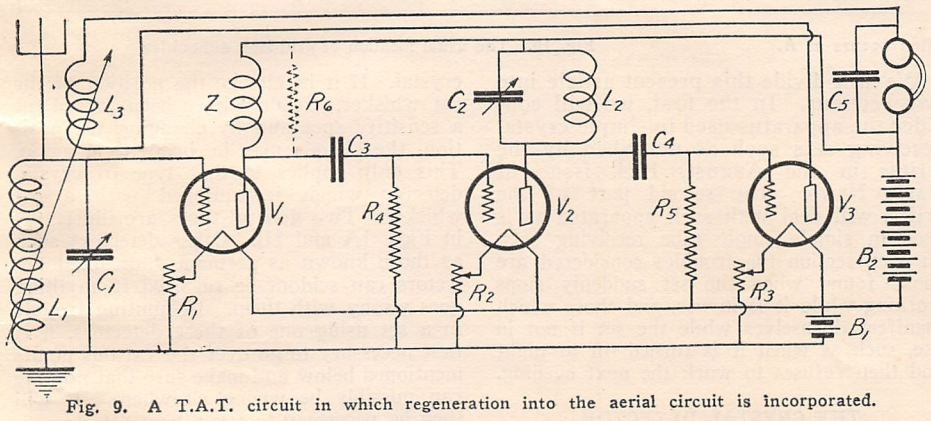



Fig. 9. A T.A.T. circuit in which regeneration into the aerial circuit is incorporated.

### RESISTANCE COUPLING

Although a choke coil has been shown in Fig. 6, this may be replaced, as shown on dotted lines, by a high resistance $R_6$ of the order of 50,000 to 100,000 ohms.

The first tube now acts as a radio frequency resistance amplifier. This method of amplification is, as stated above, particularly useful above 1,000 meters. Although some amplification is obtainable on the shorter wave-lengths, yet I think it is fairly obvious that the Fig. 6 arrangement is most suitable for the shorter wave-lengths. In both cases, however, the principle is the same; tuned circuits are separated by an aperiodic circuit.

This separation, of course, is the essential feature of these circuits. A mere combination of one method of radio frequency coupling with another is, in itself, no remarkable invention. The arrangement of Fig. 4, for example, while possibly a practical circuit, misses the whole point, and misses the whole advantage of the T.A.T. arrangement. The choke coil Z in Fig. 4 might be replaced by a resistance, but, nevertheless, the stability of Fig. 7 will be missing.

### AN ANALOGY

The T.A.T. type of circuit may be conveniently compared to a man slightly lame in one leg climbing up a hill. He gets higher and higher, one leg doing a full amount of work, with the lame leg doing a less amount, but still helping him up.

So, in the same way, in T.A.T. circuits the aperiodic coupling does not give as big an amplification as the tuned plate coupling, but, on the other hand, it serves as an excellent means of separating two antagonistic circuits which, if placed together in the same tube, would cause oscillation. Not only does the aperiodic circuit carry out these specific functions, but it also helps by giving a material degree of radio frequency amplification.

Naturally the use of these circuits halves the number of circuits to tune, and halves the number of knobs to turn. This alone will prove an inestimable boon to anyone having experience of multi-stage radio frequency amplifiers. This fact, combined with extraordinary stability, will result in much attention being given to these circuits.

### FOUR-TUBE CIRCUITS

I have successfully used several stages of radio frequency amplification without the slightest tendency towards oscillation. Loud speaker results can be obtained with ease, the only trouble being that the selectivity is rather high, and, of course, very high if regeneration is used. It was, of course, found necessary to employ regeneration because the circuits are ordinarily so very stable, due to the absence of inherent regeneration effects.

Fig. 7 shows a four-tube circuit in which a second choke coil $Z_2$ is used to couple the third tube to the last tube which acts as a detector.

In this circuit, although there are three stages of radio frequency amplification, there is only one knob, $C_2$, to turn, and the circuit is as easy to use as an ordinary two-tube tuned plate receiver, using one stage of radio frequency amplification only.

Resistances $R_8$ and $R_9$ for coupling tubes may be used instead of chokes. It will be seen in this four-tube circuit that the first tube has a tuned grid circuit and an aperiodic plate circuit, the second tube has an aperiodic grid circuit and a tuned plate circuit, the third tube has a tuned grid circuit and an aperiodic plate circuit and the fourth tube simply an aperiodic grid circuit.

### FIVE-TUBE CIRCUITS

Fig. 8 is a five-tube receiver which may be recommended; it embodies the principles of the T.A.T. system, two choke coils $Z_1$ and $Z_2$ being employed, and two tuned plate circuits $L_2$ $C_2$ and $L_3$ $C_3$. Here we have four stages of radio frequency amplification with only three controls, as against three controls on the usual two tube radio frequency amplification circuit. In the Fig. 8 arrangement we have two tubes doing their best and two tubes doing medium work.

It is to be noticed in all these circuits that resistances may be used for receiving on longer wave-lengths, while the chokes may be used for receiving the shorter broadcast wave-lengths.

### ADDING REGENERATION

Regeneration may be applied to any of these circuits in many different ways. A

(*Continued on page* 1494)

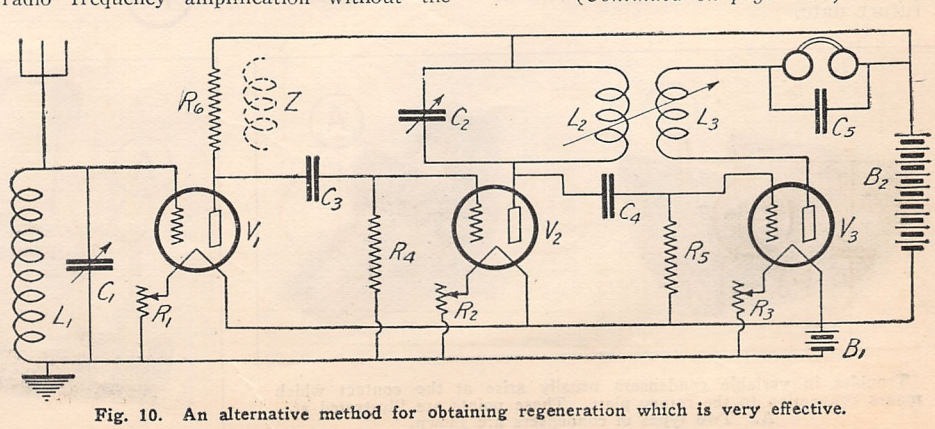



Fig. 10. An alternative method for obtaining regeneration which is very effective.

# When Your Set Stops Working

By A. P. PECK

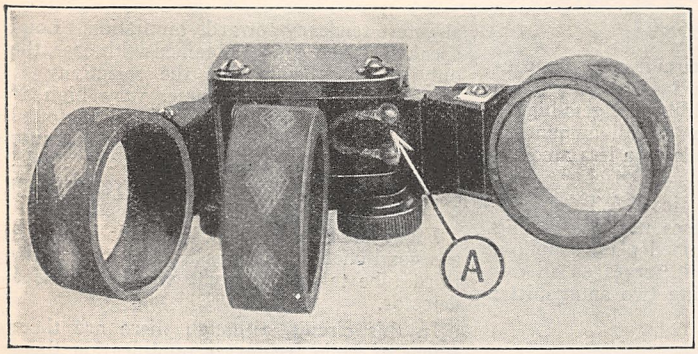



Fig. 12. Trouble in honeycomb coil mountings often occurs at A.

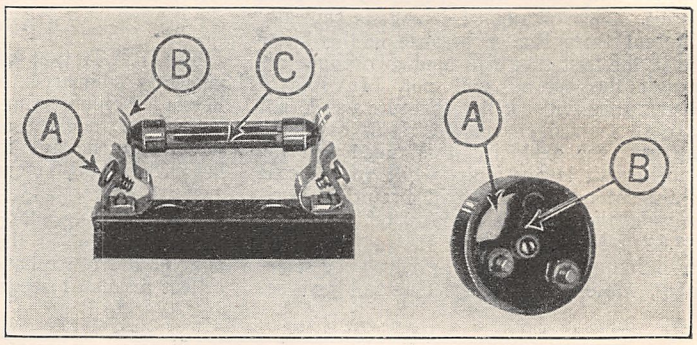



Fig. 10. The usual location of grid leak difficulties.

UNDOUBTEDLY the most exasperating experience in the life of a newly initiated radio fan is suddenly to have his radio set cease working. Usually this happens in the middle of the most interesting part of an evening's program or when the owner of the set desires to show some interested neighbor or friend how well it works. Why a radio set should stop working just when one most desires to use it, is one of those unanswerable questions of Nature. However, it usually happens so, and the first remedy is to find out just what has happened within the set to make it stop working. Simple though the set may appear, there are many many things that can go wrong with it which will cause it to cease operation. In the paragraphs below we will outline the most prominent causes of the failure of radio sets and some of those not usually noticed until after other attempts to bring the set back to life have failed. We will consider in this article only those radio receiving sets employing either crystal detectors or single vacuum tubes. We will also consider that the reader does not have a number of testing instruments at hand and, therefore, the methods of locating trouble that we will describe will be those that do not necessitate the use of testing apparatus. Hunting for trouble in larger sets where complicated amplifiers are used will be dealt with at a future date.

We will divide this present article into two sections. In the first, we will consider the apparatus used in simple crystal receiving sets such as described by the writer in the August, 1924, issue of RADIO NEWS. The second part of the article will deal with such apparatus as is used in simple single tube receiving sets. In each section the troubles considered are those found when the set suddenly stops working while it is in use, and those which manifest themselves while the set is not in use, such as when it is turned off at night and then refuses to work the next evening.

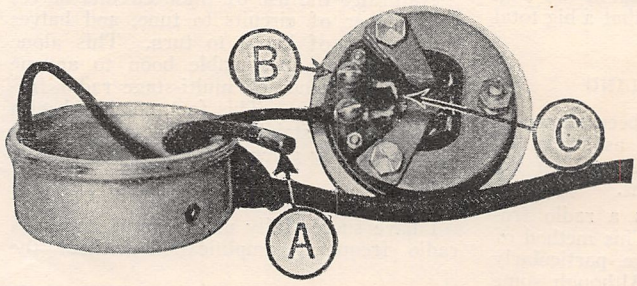
### THE CRYSTAL DETECTOR

Under the subject of crystal receiving sets, we will assume that the set has suddenly stopped working when a station is being received. The first thing to do under such circumstances is to make sure that the cat whisker, indicated by A, in Figs. 1A and 1B, is touching the surface of the crystal. If it is, change the position of the cat whisker. It may have been jarred off a sensitive spot and by changing the position, the signals may be brought in again. This only applies to that type of crystal detector which is equipped with a cat whisker. Two general types are illustrated in Figs. 1A and 1B. Other detectors such as those known as permanent or fixed detectors can seldom be repaired if anything goes wrong with them. In hunting trouble in a set using one of these detectors, it is first necessary to go over the various points mentioned below and make sure that nothing can possibly be wrong elsewhere. It will then be necessary to try a new detector.

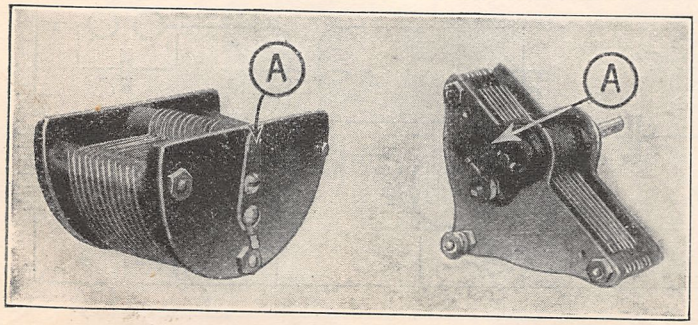
### THE HEADPHONES

If adjusting the cat whisker does not bring in a station, test the phones. The cord may be broken in the protective covering, or one of the tips may have slipped out either at the phones or at the other end of

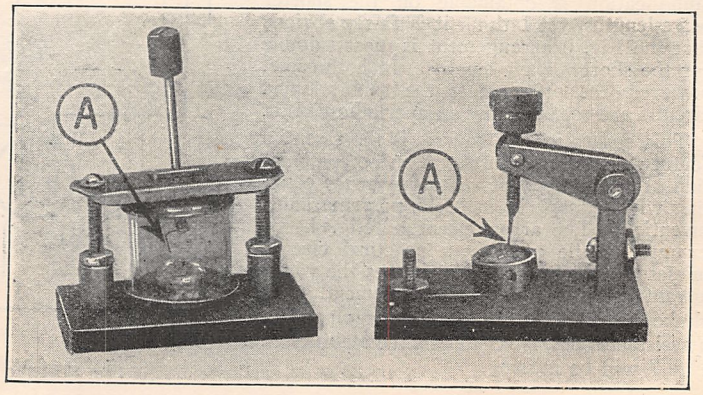
(*Continued on page* 1536)




At the left, Fig. 2, is shown the assembly of the ordinary headphone, noting points where the trouble is often found. Below, Fig. 1A and B give a clear representation of two standard types of crystal detectors.




Troubles in variable condensers usually arise at the contact which makes connection to the rotary plate. These points are illustrated at A. Two types of condensers are shown.

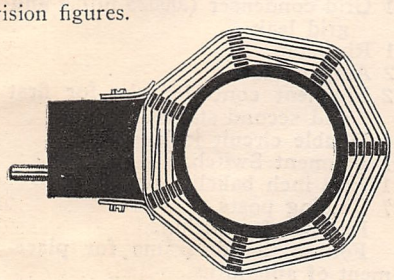


# International Radio

## ENGLAND

**Broadcasts 'Commons'**

For the first time in the history of British politics the result of a momentous division in the House of Commons was broadcast to thousands of listeners, and this was mingled with the strains of the Savoy Hotel dance music. Every quarter of an hour as the expected time of the division drew nearer, listeners heard the music fade away and the voice of the announcer tell the state of the debate, until at 11:30 p. m. came the final announcement of the division figures.



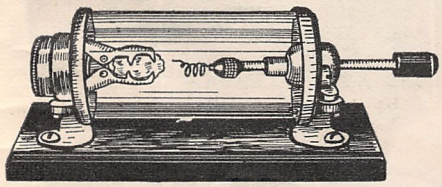
Minimum insulation reduces losses in this coil.

**Whaleboat Duplex Sets**

The whaler, *Sir James C. Ross,* which sailed recently, was fitted with a Marconi direction finder and carried five other sets for the use of her boats. The main set is a Marconi 3-k.w. telegraph-telephone transmitter. The boats let out after nightfall will be able to find the ship by means of the small receiving sets.

**Loud Speakers Defeat Hecklers**

During the recent electoral campaign, organized bands of Communists appeared at most of the Conservative and Liberal meetings and interfered with the speakers by counting in unison from 1 to 10 at different times with loud voices, thus drowning out the voices of the candidates. However, the candidates did not give up the fight, but resorted to the use of microphones and loud speakers. When the heckling began the loud speakers were turned on and the booming voices of the speakers drowned out all the noise the Communists could make.



Detector with easily removable parts.

**Radio Employment Bureau**

An English trade paper proposes to start a radio employment bureau, to act as a go-between for the constructors looking for men and the skilled men who are in need of work.

**Undraped Broadcast Studio to Aid Artists**

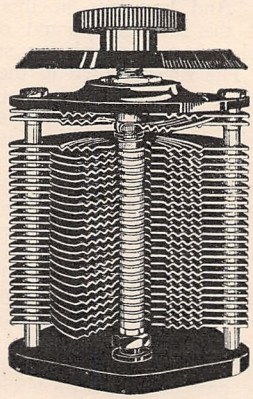
The British Broadcasting Co. has completed plans for a larger studio in the Institute of Electrical Engineers in London, the feature of which will be the absence of draperies. It is said that in a heavily draped studio such as is in common use today the artists have the impression of singing on a mountain top and their voices seem to lack strength and sound strange, which leads to uneasiness and an attempt to force the voice, making it sound harsh to the listener.

**New Apparatus on the English Market**

Herewith are illustrated some new snap terminals which will be helpful to the experimenter. The snaps are large replicas of those that we are familiar with on gloves. As shown in the illustration, a lug to which a wire may soldered may be inserted in the middle of a snap. These snap terminals also come mounted on screws and may be attached to panels, terminal boards, etc.

A new crystal detector is famous for the ease with which either the crystal or the cat whisker may be replaced. The crystal holder is a spring clip, which may be removed by a slight movement of the end holder. The contact end is removable by loosening the two screws in the right hand bracket and then turning the whole end slightly to clear the screw heads.

A new coil winding form that is a time saver for English fans who wind their own is shown herewith. The pins are easily removable after the coil is wound and the spacing of the turns may be close or wide, depending on the nature of the coil.



Design of plates to eliminate buckling.

The design of the condenser plates shown above is a radical departure from the ordinary. The manufacturers of this condenser say that the grooved plates have removed the bugbear of buckled plates. Also specially designed cups on the fixed plates eliminate spacing washers and make the spacing between plates more accurate.

The advantages of a type of inductance (shown herewith) is that there need be no insulation on the wire, thus eliminating any losses due to cotton, silk, tape or shellac.

A new construction of a two filament tube was recently announced in England. Although the idea is not new, the method of construction bears mention.

One of the filaments is connected, together with the grid and plate, to the contact pins in a cap at one end of the glass bulb in the usual way. The other filament is similarly connected to contact pins in a second cap, which is attached at the opposite end of the tube and the same grid and plate are connected to their respective pins in the second cap.

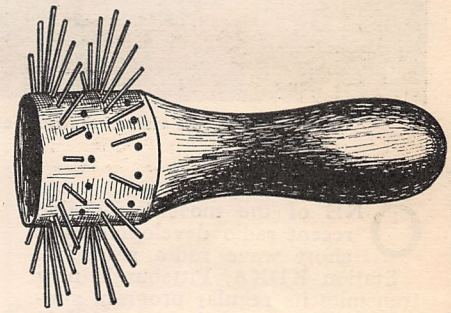
Thus the grid and plate are common to both ends, but each end operates a different filament. A bakelite cap is provided to cover the projecting pins in the unused cap, thus preventing accidental contacts.

**Compulsory Radio for Miners**

An English mining engineer is reported to have nearly perfected a very small portable receiver which can be carried easily by miners. He hopes to have the use of this tiny set made obligatory in British mines. The manifold uses of such a set in rescue work are easily imagined.

**Directional Sending Study**

A giant seaplane has been equipped with a combination transmission and receiving set for radio telephony, with the idea of co-operating with the land stations in the study of the directional tendencies of ether waves.



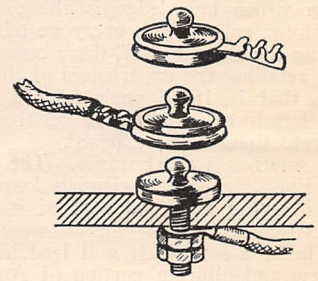
The metal part of the coil form keeps the pins in correct positions.

**More Time Signals**

An English radio journal advocates the broadcasting of time signals at 8 a. m. as well as the usual ones at 10 p. m. This is an excellent idea, as there are many people who would like to set their watches and clocks daily, but who are out in the evening. Also the morning is a logical time to see that time pieces are correct.

**Escaped Monkey Mistaken for Static**

A monkey named Joey caused an amateur in Camberwell to believe that England was experiencing some tropical static. Joey found his way to the roof and made use of the antenna he found there for a tight rope. The amateur happened to be listening in at the time and described the sounds as raucous.



Handy clip-terminals for the experimenter.

## FRANCE

**Arc Tube**

Messrs. Dunoyer and Toulon, who have published two papers before the Academy des Sciences in Paris regarding their experiments with the mercury vapor arc amplifier, have brought forth a theory explaining some of the odd reactions noted in this work.

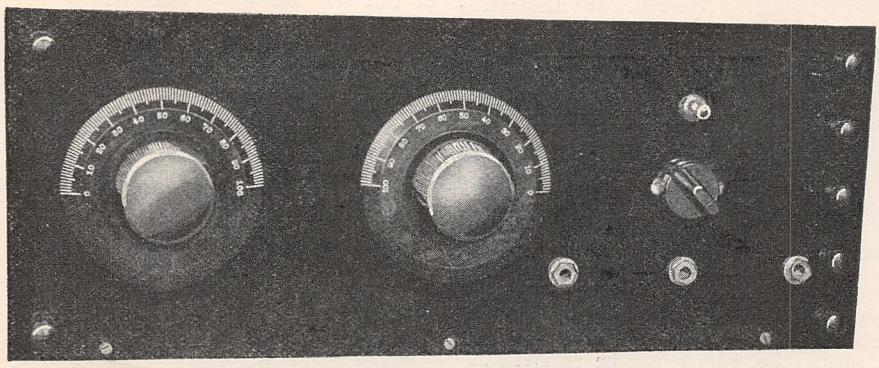
They believe that it is the presence of an unusual number of positive ions in the maintenance arc vapor that brings about the

(*Continued on page* 1556)

# A Good Short Wave Receiver

## By THE STAFF OF RADIO NEWS

*In view of the constantly increasing activities in short waves, the importance of the band of frequencies lying between fifty and one hundred and fifty meters cannot be overestimated.*



Above is a view of the front of the set described in this article.

**ONE of the most remarkable recent radio developments is short wave radio reception. Station KDKA, Pittsburgh, now transmits its regular program simultaneously on the short wave of 84 meters. The same is the case of WGY, which transmits at 107. These low wave-lengths have tremendous penetrating power, and can readily be received almost anywhere in the country by means of the set shown here. At these low wave-lengths, the efficiency is much greater. This set receives regularly, in New York, French amateur stations on wave-lengths of 70 to 120 meters. For the experimenter this set should prove of great interest.—EDITOR.**

WHEN the regular DX stations begin to pale and the old thrill no longer accompanies a 50-mile addition to the range of the set, it is time for the listener to look about for new fields to conquer. His logical course under these circumstances is to find a field in which knowledge is the exception and not the rule. With everyone telling of receiving the regular stuff, there ceases to be fun in retailing the experiences of the night before, that is, if all one's friends have a handy bunch of experiences of their own similar to those being exposed.

The solution is short waves. The field is new. Even the expert scientists know little about it. And the good part of it is that it is extremely easy for the ordinary listener to build a set which will lead him into this new and alluring portion of America's greatest indoor sport.

And there is no deficiency in the number of stations to which the builder may listen. And location makes no difference, since the broadcasters using the short waves put much more power into their tubes at the short wave-lengths than at the standard frequencies.

The set described in this article is very much like the ordinary regenerator. The only difference lies in the constants of the circuits. Such sizes have been chosen for the coils as to make the ordinary .0005 mfd. variable condenser usable in the circuit. In fact, if the builder has a regenerator already in working condition, only a couple of changes will be necessary for conversion of the set into an extremely efficient "short waver."

The panel is a standard 7 by 18 inch bakelite strip. Its drilling will depend upon the parts used, so no definite directions will be given for this operation. The apparatus should be placed as nearly similarly to the arrangement given in the photograph as possible for the sake of lead shortness. And when working at the higher frequencies this point is extremely important.

The tuner is of the aperiodic primary low loss type. And low loss in this instance means that the smallest amount of insulation possible must be used for supporting the coils. The tuner shown in the illustration employs the stagger method of winding, but straight winding will serve just as well if the spacing between the turns is equal to the thickness of the wire.

The primary consists of about six turns of heavy wire—No. 14 will serve excellently—spaced broadly and wound over the secondary. The secondary consists of 14 to 16 turns of No. 18 D.C.C. wire; the tickler will have approximately the same number of turns, wound on a spider-web form. The secondary may be wound as shown by placing 15 large nails or pegs equally distanced around the circumference of a circle three and one-half inches in diameter. Any handy board will do to support the nails. Their heads must be removed before driving, so that the completed coil will slip off easily. The use of twenty-penny nails is recommended.

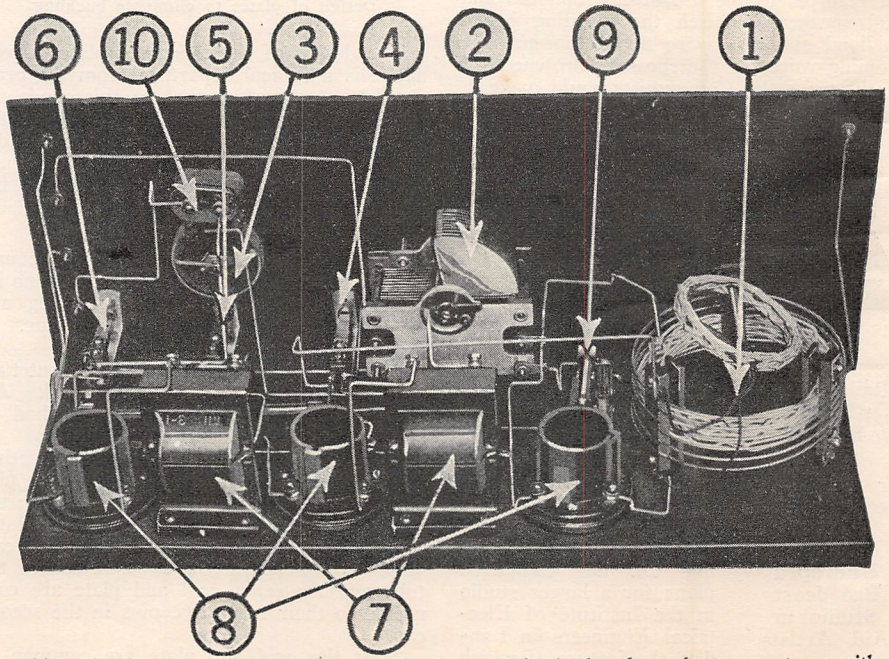
With the form completed, begin the coil at one nail, pass the wire on the outside of two of the nails, then to the inside of two, and then to the outside of two and so on until 11 turns have been made. The supports for the coil are simply four short strips of hard rubber or bakelite, each drilled at both ends. Two of the strips are placed on one side and two on the other, of the coil, diametrically opposite each other. The strips are used in pairs, one strip inside and the other outside, with small screws and nuts holding them together and clamping the coil between.

With the secondary in place, the primary is wound directly over the outside of the

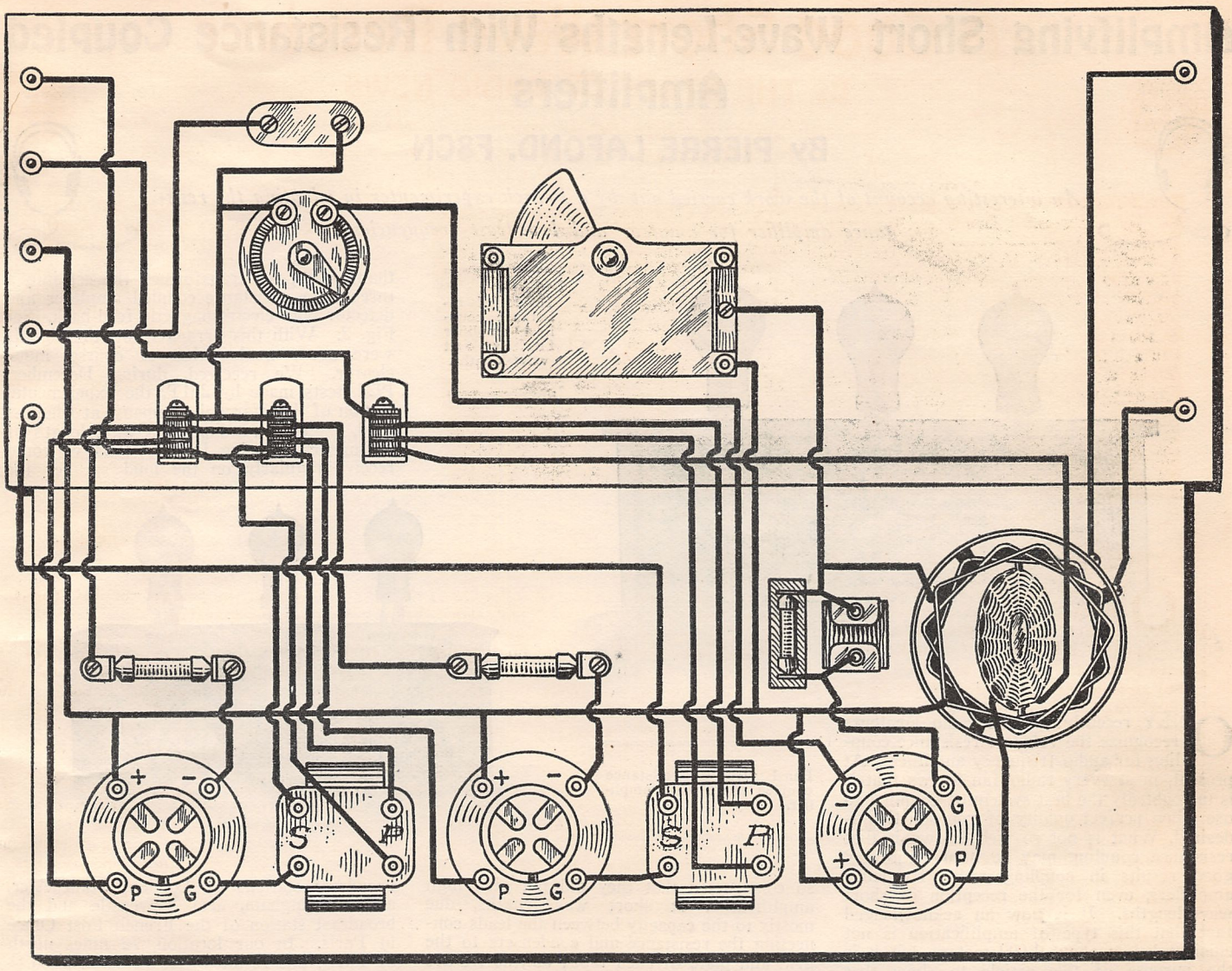
Below is a complete list of parts to be used in the short wave receiver. All instruments should be of the low loss type.

### LIST OF PARTS

1 23-plate variable condenser.
1 Short wave coupler.
2 Audio frequency transformers.
3 Sockets.
1 Grid condenser (.00025 mfd.) and grid leak.
1 Rheostat.
2 Amperites.
2 Filament control jacks for first and second stages.
1 Double circuit jack.
1 Filament Switch.
1 7x18 inch bakelite panel.
7 Binding posts.
Bus bar for wiring.
Follow the diagrams for placement of apparatus.




Above is given a rear view of the completed set. 1 is the low loss, short wave tuner with aperiodic silver plated primary. 2 is the variable condenser of the low loss type, it is the standard .0005 variety. 3 is the filament rheostat for the detector. 4 is the filament control jack for the detector. 5 is the same thing for the first stage of audio frequency and 6 the jack for the second stage. The two low ratio audio frequency transformers are indicated at 7. The three sockets for the tubes are noted at 8 and the grid leak and condenser at 9. 10 shows the battery switch.




Panel and base board layout for the set including wiring scheme and placement of the apparatus is shown above.

supports. Extra drillings will have to be made to provide fastenings of the primary. The turns of this coil should be spaced according to the proportions shown in the photograph.

The tickler may be wound on a large spider-web form. The inside diameter of the tickler should be two inches. After the winding has been made in the regular fashion, consisting of 16 turns, the coil may be bound with thread and the form removed. This is accomplished by cutting the center out of the form and then removing the wedges.

It may be supported on a hard rubber or bakelite rod. If the rod is selected of such a size that it will fit a bushing, similar to those used with jacks or switches, it may be pushed through two of the spaces of the coil diametrically opposite. This coil should be so mounted that only one third of it is below the top turn of the secondary winding.

Some experimenting may have to be done with the size of the tickler before the proper value is obtained so that control may be had over the whole range of wave-lengths.

The mounting of the tuning instrument should be such that the leads to the remainder of the apparatus are as short and direct as possible. For this reason it will be found best to follow the layout of the instruments shown in the photographs.

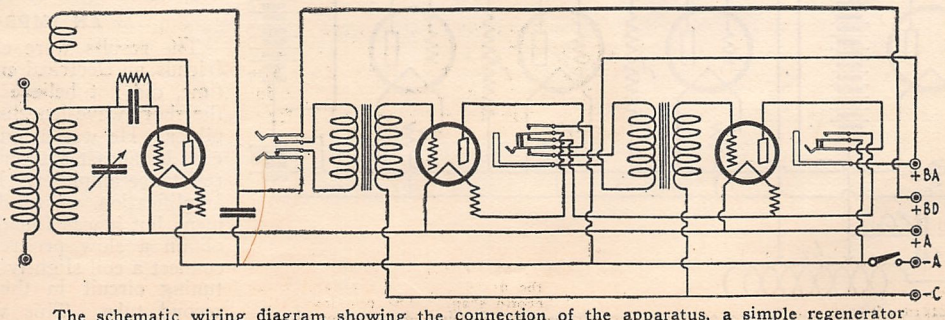
Filament control jacks are employed for the sake of economy and efficiency. Amperites or automatic control resistances are used to regulate the supply of current to the filaments of the two audio frequency tubes. A rheostat is employed in connection with the detector, however. Clarity and volume, together with a decided saving of "B" battery current are obtained with the use of a "C" battery in the grid returns of the two audio stages.

A variable grid leak will be found advantageous in the detector circuit.

A note must be added here for those who contemplate purchasing the tuner on the market and reconstructing it for use in the present set. The low loss type recommended is plainly shown in the photograph. It can be purchased in almost any radio store and only a few changes are necessary for making it available in the short wave circuit. Sufficient turns should be removed from the bottom of the secondary to leave the required number. The turns must be removed from the bottom of the coil so as to leave the tickler as near the secondary as possible. The tickler is reduced in the same manner from the inside out. The silvered primary winding may be left intact, as it is built to operate aperiodically.

Any good condenser may be employed, but it would be best to find one with low losses. This characteristic may be checked by going through the reports of the Radio News Laboratories. This information is available for every instrument which has been submitted for test. The only method by which the efficiency of a condenser may be learned is through such tests as are made in the Laboratories. It would be quite silly to construct a set deliberately seeking low losses, and then incorporate a condenser with "mud" insulation of inferior design. A condenser should be judged by its high frequency resistance.

If the design given has been followed and care has been observed, the set will bring in all stations between 50 and 200 meters—and bring them in roaring.

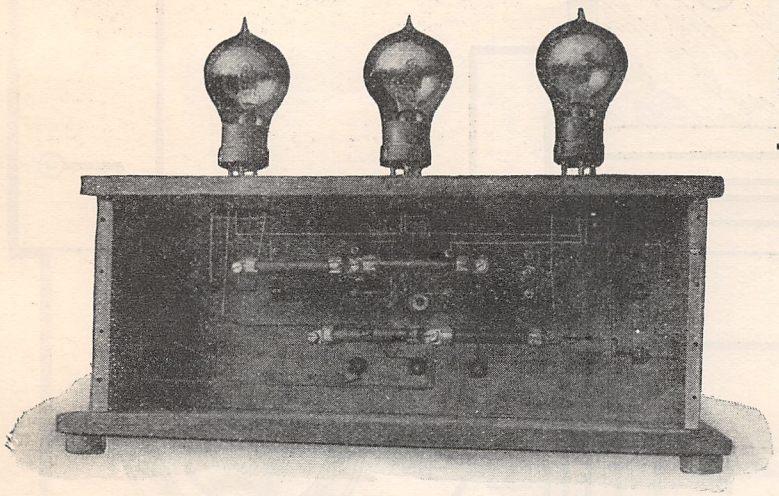



The schematic wiring diagram showing the connection of the apparatus, a simple regenerator and two steps of audio frequency amplification is shown above.

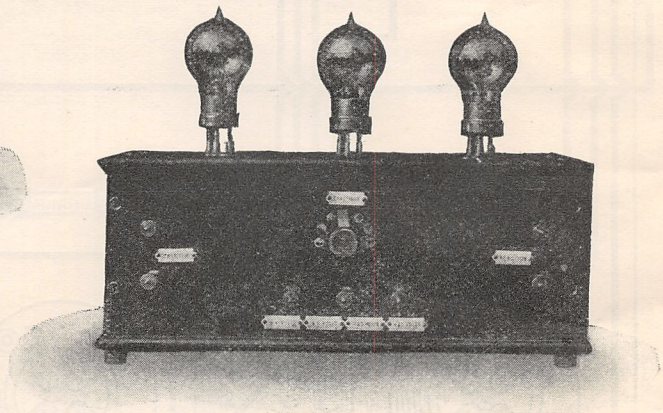
# Amplifying Short Wave-Lengths With Resistance Coupled Amplifiers

By PIERRE LAFOND, F8CN

*An interesting account of the work carried out by a French experimenter in adapting the resistance amplifier for amateur and broadcast frequencies.*



Inside of resistance coupled amplifier for short wave-lengths.



Panel view of resistance coupled short wave amplifier.

ONLY recently did the radio amateurs recognize the value of resistance coupling for audio frequency amplifiers. At present, most every radio fan knows that it is undoubtedly the best system of coupling to use when perfect quality of reproduction is desired. What is not so well known is that resistance coupling may be used with very good results in coupling radio frequency amplifiers, even for the reception of short wave-lengths. It is now an acknowledged fact that this type of amplification is not efficient below about 1,000 meters, but it is the purpose of this article to show that wave-lengths as short as 200 meters may be amplified efficiently with the resistance coupled amplifier, if the proper care is taken in construction.

A proof that this system of amplification gives results was the reception in France of a speech delivered by Mr. Paul Dupuy, editor of a large Paris newspaper, delivered through stations WJY and WJZ in December, 1923.

Resistance amplifiers for radio frequency amplification were described in the March, 1921, issue of RADIO NEWS, in an article by R. E. Lacault. In that article were illustrated a few types of French radio frequency amplifiers. These amplifiers were so constructed that they did not give high amplification at short wave-lengths, due mostly to the capacity between the leads connecting the resistance and condensers to the grid and plate of each tube; but, as we are going to show in this description, it is possible to receive the amateur wave-lengths with resistance amplifiers.

### EARLY TESTS

We succeeded, as far back as December, 1922, in receiving short wave-lengths on a three stage resistance coupled amplifier after the following events happened: During 1922, we used a four tube receiver, the first tube acting as tuned radio frequency amplifier, the second as detector, with electromagnetic feed-back and the two others as audio frequency amplifiers. The diagram of this receiver is shown in Fig. 1. This set gave very good results, but was somewhat critical to tune. Since we wanted quality, rather than power, we transformed the set into a three stage resistance coupled amplifier and detector with electromagnetic feed-back. See Fig. 2. With this arrangement, the signals were much weaker, but of course, much clearer. We received, during December, 1922, tests made by 2MT, the experimental station of the Marconi Company, at Chelmsford, England, sending on a wave-length of 450 meters. During January, 1923, we could receive regularly on the loud speaker the broadcast stations of London, Manchester, and Birmingham, also Newcastle and the broadcast station of the French Post Office in Paris. In our location, 72 miles north of Paris, this result was considered good.

On one occasion our first tube burned out, and we decided to receive directly on the resistance amplifier. We found that reception of the short wave-lengths from 300 to 600 meters was still very good and we started to experiment in order to see how short a wave-length we could receive on this amplifier by removing all the unnecessary capacity in the circuit. The amplifier was taken apart and mounted "bread-board style" with some Mulard resistors and small variable condensers for coupling the plates and grids of the various tubes. Maximum amplification on the broadcast wave-length was obtained, when the amplifier was connected as shown in Fig. 3, and with the following constants:

Standard French tubes,
Plate resistance R′—75,000 ohms.
Plate resistance R″—70,000 ohms.
Grid leak R′—4 megohms.
Grid leak R″—3 megohms.
Coupling condenser $C_1$—.0005 mfd.
Coupling condenser $C_2$—.00005 mfd.
Phone condenser $C_2$—.004 mfd.
By-pass condenser $C_3$—2 mfd.
Plate voltage—80 volts.

### AN IMPROVEMENT

The results were checked by one of our friends, an electrical engineer, who, up to that time, did not believe that we could receive the short wave-lengths with this type of amplifier. He was astonished to hear the foreign broadcast stations, as received with this resistance amplifier. In order to get greater amplification, we tried a feed-back arrangement, but it was found necessary, in order to obtain a slow progressive amplification, to connect a coil slightly larger than that of the tuning circuit in the plate circuit of the second tube. This was a regular honeycomb coil and is shown as 2 in the circuit.

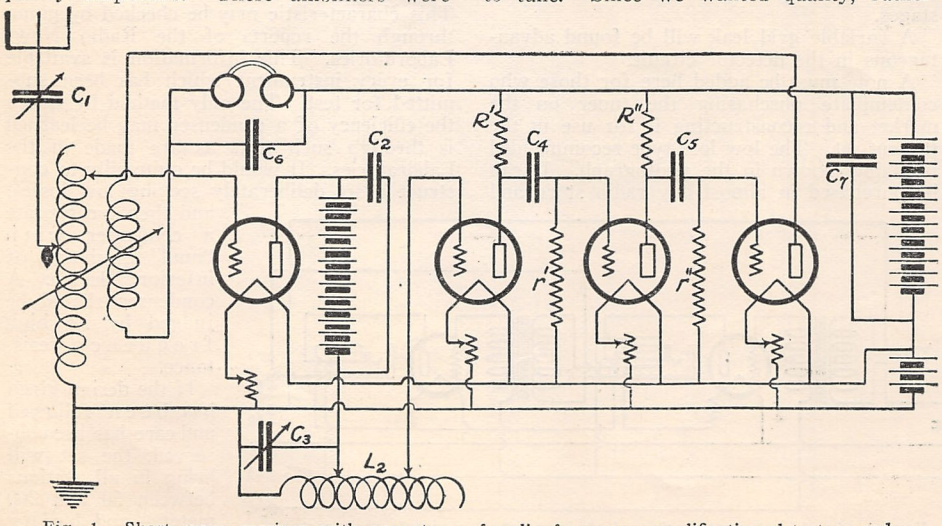



Fig. 1. Short wave receiver with one stage of radio frequency amplification detector, and two stages of resistance coupled amplification.

However, even with this arrangement, the feed-back control was very critical and required great skill and care in order to obtain maximum amplification.

During May, 1923, we built a three stage radio frequency resistance amplifier, with which we were able to receive wave-lengths as short as 180 meters using ordinary tubes. In order to obtain such results, it was necessary to connect the leads directly to the prongs of the tubes and to space the tubes 4 inches apart, to avoid any capacity effect between the leads connecting the various elements in the high frequency circuit. The coupling condenser were ordinary, small mica fixed condensers and all the connections were made with heavy copper wire, so that the resistance and grid leak are supported in the air and connected with as short leads as possible.

### AMATEUR RECEIVER

As for results, we received the amateur transmission from station F8AX at Algiers, (about 900 miles) on 200 meters. We could hear the signals on the loud speaker using this amplifier with one stage of audio frequency amplification; also the radio telephone transmission from the Radio Club of Luxemburg on 205 meters. We regularly received the English broadcast stations from Glasgow and Aberdeen as loud as the London stations, and in the early morning, we could hear with good audibility, some of the American broadcast stations. Although the efficiency of this system of amplification is not as great as that of the transformer or choke coil coupling, we consider the above results to be very good, and a further advantage, which is certainly of importance when receiving radio telephony, is the quality of the speech and music which is extremely pure. The antenna used with this receiver is composed of four wires, 90 feet long and spaced four feet apart. It is erected between a house and a pole 45 feet high.

We hope this description will prove interesting to the American amateurs, especially to those who cannot afford the more expensive types of amplifiers using numerous coils and variable condensers. We would suggest to anybody wishing to build such a resistance amplifier for short wave reception, to use vacuum tubes having a small internal capacity, such as the UV-199, C-299, Myers' tubes, Western Electric "N" tubes, better known as the "peanut tubes," or the small DeForest tube, which is now available in the United States.

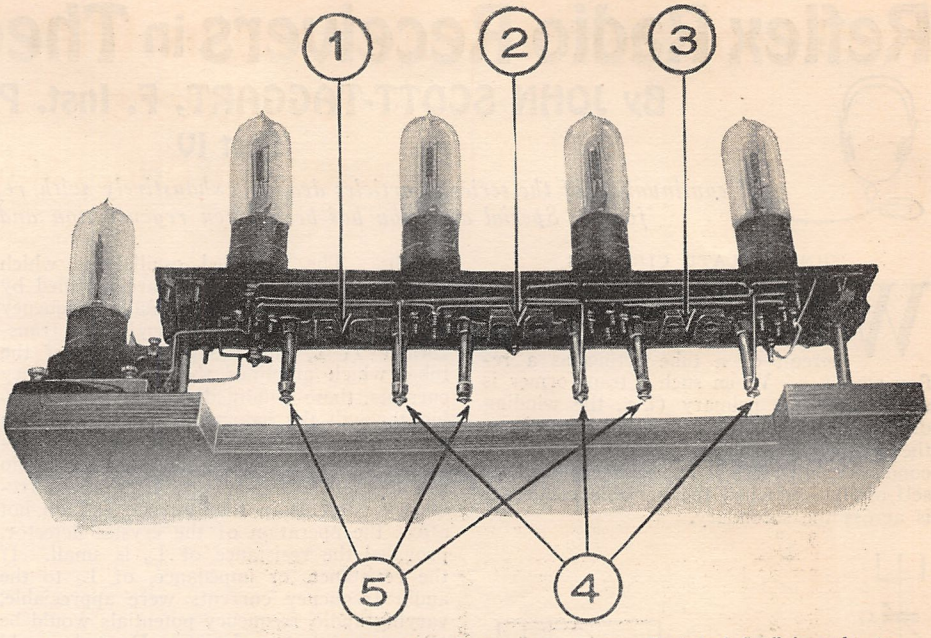
## FIGHTING INTERFERENCE

Interference, which has kept many potential fans from accepting radio seriously, is gradually being eliminated, according to Dr. J. H. Dellinger, of the Bureau of Standards. Fans who suffer from local interference have learned how to avoid it by using a selective receiving set, a short aerial instead of a long one, a loop antenna, when the design of the receiver permits, or installing a wave trap. On the other hand, there are still some listeners-in so behind the times as to wonder why they cannot separate two broadcast stations when they have nothing but a fixed crystal set. Washington broadcast listeners whose crystal sets were equipped with a simple tuner found little difficulty in getting either WRC or WCAP during the recent simultaneous tests on separate wave-lengths. Obviously, the development of the radio art, in broadcasting at least, is not solely up to the engineers; it is dependent to a considerable extent on the fans themselves, who must keep posted on developments and make their sets as selective as possible.

"There is no simple cure-all for radio interference," Dr. Dellinger declares. Both natural and man-made interference must be coped with, and the former is found the more difficult to overcome. Nevertheless, this brilliant radio research worker is confident that the ether will gradually be cleared of impediments or that these difficulties will be overcome by scientific progress, and that "radio will go on developing to new triumphs and greater service." Dr. Dellinger points out that interference arises from many causes. Vast effort is being made to analyze these causes and to apply remedies. In a recent discussion he said in part:

"The radio apparatus first used produced waves of very broad tuning, so that it was very difficult to tune out other waves. Improvements in tuning have gone steadily on, until we have now about reach the limit of

(*Continued on page* 1496)




The above set was built in the Radio News Laboratories by the Technical Staff in order to check the author's theories.. WD-11 tubes were mounted on the bakelite strip and the condensers Nos. 1, 2, and 3 connected without leads to the plate and grid prongs of the tubes. The plate resistances, No. 4, and the grid leaks, No. 5, were mounted vertically to shorten connections. The values of these resistances lie between 50,000 and 80,000 ohms. The circuit contains three stages of resistance coupled radio frequency amplification, a detector, and one stage of transformer coupled audio frequency amplification.

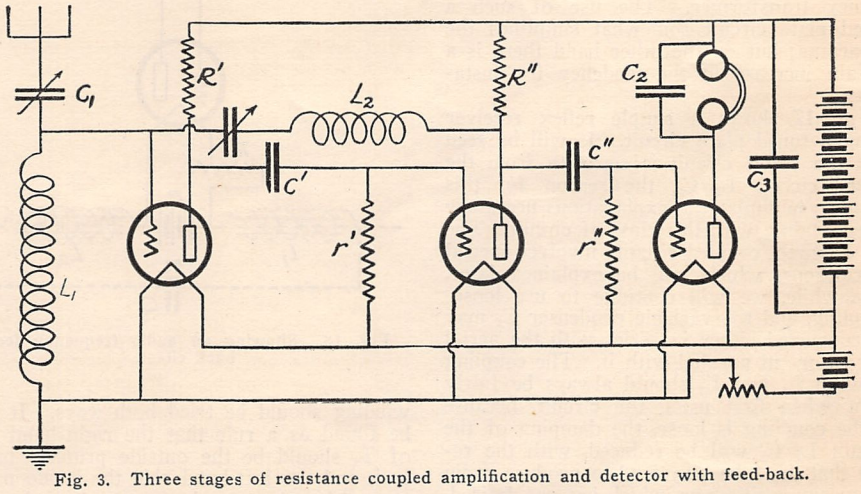



Fig. 3. Three stages of resistance coupled amplification and detector with feed-back.

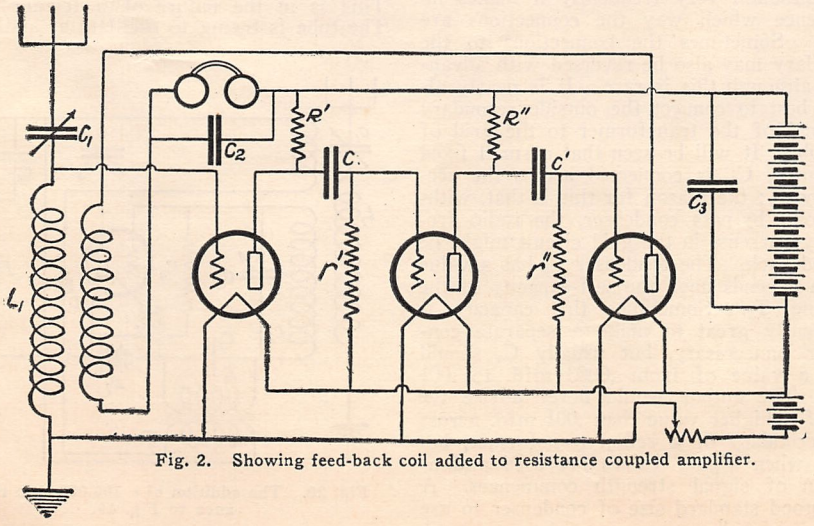



Fig. 2. Showing feed-back coil added to resistance coupled amplifier.

# Reflex Radio Receivers in Theory and Practice

By JOHN SCOTT-TAGGART, F. Inst. P., A.M.I.E.E.

## Part IV

*A continuation of the series of articles dealing exhaustively with reflex amplification in all its forms. Special attention has been given regeneration and crystal detectors*

### TUNED PLATE CIRCUITS

WE have so far considered, for the purposes of simple explanation, the use of a transformer in the plate circuit of a tube acting as a reflex amplifier. When such a transformer is used, either the primary (*i. e.*, the winding directly in the plate circuit of a tube) or the secondary may be tuned by a variable condenser, but there is less tendency towards self-oscillation when the variable condenser is across the secondary.

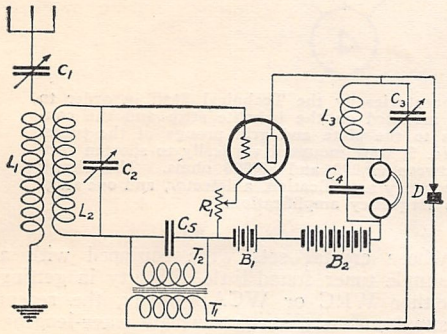



Fig. 17. A simple reflex receiver used with tuned plate circuit.

We now come to consider the use of a tuned plate circuit in place of the radio frequency transformer. The use of such a tuned plate circuit somewhat simplifies the apparatus; but on the other hand there is a certain increase in the tendency for instability.

Fig. 17 shows a simple reflex receiver using a tuned plate circuit. It will be seen that the aerial circuit is separate from the closed circuit $L_2$ $C_2$, the reason for this being to minimize the explanations necessary when dealing with this class of circuit. The use of direct coupled circuits involves special precautions, which will be explained later. Meanwhile, we will continue to use loose-coupling, and the variable condenser $C_1$ may be connected either in series with the aerial coil $L_1$ or in parallel with it. The coupling between $L_1$ and $L_2$ should always be fairly tight when first using the circuit, because if the coupling is loose, the damping of the circuit $L_2$ $C_2$ will be reduced, with the result that the tube may tend to produce radio frequency oscillations, which are not desired.

The radio frequency currents are applied by means of the circuit $L_2$ $C_2$ to the grid and filament of the tube in Fig. 17, and in the plate circuit of this tube we have the inductance coil $L_3$ shunted by the variable condenser $C_3$. Telephones and the usual high voltage battery, $B_2$, are included in the plate circuit of the tube, and to act as a by-pass for the radio frequency currents a condenser $C_4$ of .002 mfd. capacity is connected across the telephones T. This condenser $C_4$ might alternatively be connected across the right-hand side of T and a terminal of the filament battery $B_1$. It is, however, quite customary, in tube receiving apparatus, to shunt the high-voltage battery $B_2$ separately by a large condenser of 1 microfarad capacity, the purpose of this condenser being to prevent small fluctuations of plate voltage. Such a reservoir condenser is particularly useful when using reflex circuits. The circuits $L_1$ $C_1$, $L_2$ $C_2$, $L_3$ $C_3$ are all tuned to the incoming wavelengths. The amplified oscillations which appear in the circuit $L_3$ $C_3$ are rectified by the crystal detector D, the audio frequency currents being passed through the transformer $T_1$ $T_2$ into the grid circuit of the tube, which amplifies the audio frequency currents, these amplified currents then passing through the inductance $L_3$ and through the telephones T. The audio frequency currents, in passing through $L_3$, of course, do not interfere in any way with the radio frequency currents in that circuit, and do not affect the operation of the crystal detector, provided the resistance of $L_3$ is small. If the resistance, or impedance, of $L_3$ to the audio frequency currents were appreciable, varying audio frequency potentials would be set up across the detector D, and would modify its rectifying properties, with the result that distortion would occur. This effect, however, would not, in ordinary circumstances, be noticeable.

The connections of the transformer windings, $T_1$ $T_2$, may be as follows: The left-hand side of $T_2$, *i.e.*, the side which is nearest the grid, should always be the outside secondary terminal of the transformer, while the right-hand side, of course, should be the inside secondary terminal. The primary $T_1$ has two terminals, inside primary and outside primary, and the connections to this

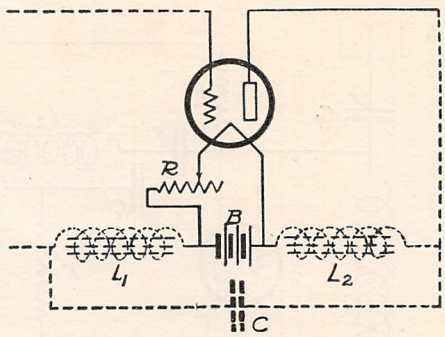



Fig. 18. Showing an audio frequency feed-back effect.

winding should be tried both ways. It will be found as a rule that the right-hand side of $T_1$ should be the outside primary terminal, and the left-hand side the inside primary, although very frequently it makes no difference which way the connections are made. Sometimes the connections to the secondary may also be reversed with advantage, although this is rare. It is nearly always best to connect the outside secondary terminal of the transformer to the grid of the tube. It will be seen that a small fixed condenser, $C_5$, is connected across the secondary $T_2$; the reason for this is that, without some by-pass condenser, the radio frequency currents in the grid circuit might be choked back. The condenser $C_5$ has a value which depends upon the self-capacity of the winding $T_2$. Sometimes this capacity is sufficiently great to make a separate condenser unnecessary, but usually $C_5$ should have a value of from .0003 mfd. to .001 mfd. The author would never advise the use of a higher value than .001 mfd. across the secondary of a reflex transformer, because when higher values are used a diminution of signal strength commences. A very good standard size of condenser to use across the secondary of a transformer which is included in a radio frequency circuit is .001 mfd.

### POSSIBLE CAUSES OF BUZZING

This circuit, like every other reflex circuit, is sometimes liable to produce a steady buzzing noise in the telephones, which is extremely unpleasant. There is one fundamental cause of buzzing, which is inherent in every kind of reflex circuit. A full explanation of this phenomenon was given previously, when it was pointed out that in many cases the feeding back of the audio frequency currents into the grid circuit of the tube modulates the carrier wave, and the modulated currents, after amplification by the tube, are rectified by the crystal and produce audio frequency currents, which are fed back into the grid circuit again. This produces what we propose to call a chain of audio frequency feed-back. In this case the chain is very different from the usual kind, as it depends upon a radio frequency link. This, however, is by no means the only cause of buzzing in a reflex circuit.

### A COMMON FAULT

Probably a much more common fault results from simple audio frequency feed-back. Audio frequency feed-back is similar, in principle, to radio frequency feed-back, and audio frequency self-oscillation may readily occur in an audio frequency amplifying apparatus. In the case of say a three-tube audio frequency amplifier using iron-core inter-tube transformers, it often happens that a musical note is produced through the tubes oscillating at audio frequency. A similar phenomenon is always likely to occur in a reflex circuit, the reason being that the amplified audio frequency currents in the plate circuit are liable to be fed back into the grid circuit, and when this happens audio frequency feed-back is obtained which, if sufficiently strong, may set up actual audio frequency oscillations producing buzzing.

It is only necessary that sufficient audio frequency energy should be fed back from the plate circuit of the tube to the grid circuit to produce a decided feed-back effect. This effect will frequently strengthen signals, although usually at the sacrifice of purity. A certain distortion will always occur, and frequently a specially strong signal will set up audio frequency oscillation. This is in the nature of a trigger effect. The tube is trying to oscillate at audio fre-

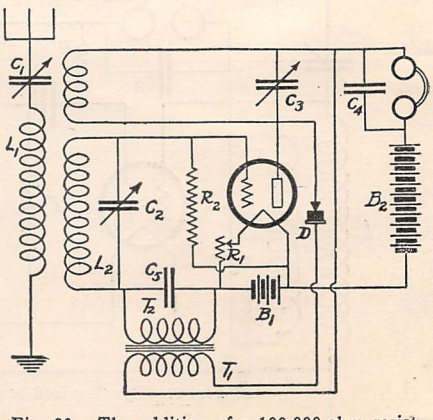



Fig. 20. The addition of a 100,000-ohm resistance to Fig. 19.

quency, and only requires a kick, as it were, to start it. Of course, in some cases, the audio frequency reaction is so strong that the set, when joined up, will start buzzing.

The different causes of audio frequency oscillation in a reflex circuit are numerous, and the author has made a special study of the problem with the view of eliminating all the possible troubles. The only one which it is not definitely possible to eliminate is the fundamental effect described in the last issue. The other troubles can be usually got over by certain precautions. Probably the simplest thing to do, if there is a tendency towards audio frequency buzzing, is to reverse one of the transformer windings, preferably the primary winding of an iron-core transformer. This will tend to produce a reverse feed-back effect, but owing to various complications in the feeding back of the audio frequency energy, it is frequently possible that even a reversal of a transformer winding will not stop the oscillation. A somewhat similar effect is frequently obtained in radio frequency circuits where the reversal of the feed-back coil of a tuned plate circuit will not prevent self-oscillation owing to the peculiar capacity coupling taking place.

In the circuit of Fig. 17, by the use of a tuned plate circuit, $C_3$ $L_3$, we are liable to get an audio frequency feed-back effect, due to the fact that one side of the telephones is connected to one side of the primary winding $T_1$, of the transformer $T_1$ $T_2$. We have here, then, a direct connection between the audio frequency output circuit of the tube and the transformer which passes the currents into the grid circuit. When a radio frequency transformer is employed, as in Fig. 11, there is no direct connection between the audio frequency output circuit and the transformer which feeds the current back into the grid circuit of the tube. We, therefore, do not have the possibility of ordinary audio frequency feed-back, but this ordinary effect is sometimes obtained in the Fig. 17 circuit.

The audio frequency currents, which pass through the telephones T during the operation of the circuit, set up varying potential differences across T, because T is acting like an iron core choke coil or other high impedance. If the voltages across T are suitably communicated back into the grid circuit of the tube, a direct audio frequency feed-back effect is obtained.

Many will, no doubt, at some time or another, have tried connecting one terminal of the telephone receivers to the transformer carrying audio frequency currents. It will be found that by simply touching one terminal of the telephone receivers to a circuit carrying audio frequency currents, it is possible to hear perfectly plainly in the phones, although the other terminal of the phones is quite free. Of course, louder results are obtained when the audio frequency current is actually passed through the telephones, but the latter will certainly pick up audio frequency currents from simply one terminal. Similarly, one terminal of a transformer primary, if connected to a circuit carrying audio frequency currents, will set up alternating currents in the secondary of the transformer which will work telephones connected across this secondary. Various peculiar effects of this nature are possible, and the usual explanation is that the circuit is completed by some vague capacity somewhere.

In Fig. 17 the fact that one side of the telephones T is connected to the primary of a transformer $T_1$ $T_2$ is sufficient for the varying voltages across T partially to energize the transformer $T_1$ $T_2$ and to set up currents in the secondary which will be fed into the grid circuit of the tube and reamplified by it. This may readily result in a peculiar audio frequency feed-back effect. It is perfectly well known that there is a very appreciable capacity effect between the primary and secondary windings of a transformer, and this capacity effect is in existence between every turn of the primary and every turn of the secondary. The position is, therefore, very complicated, and, apart from saying that there is a form of capacity coupling, and the possibility of the completion of audio frequency circuits by the incidental capacities in a transformer, it is impossible to state very definitely how the feed-back effect gets back from the plate circuit to the grid circuit, but, nevertheless, it frequently does so.

One possible effect which may be obtained is that illustrated in Fig. 18. In this circuit it will be noticed that two iron core inductances, $L_1$ and $L_2$, are connected in the grid and plate circuit of a tube, a capacity C being connected across the ends. Such a circuit will readily oscillate, producing audio frequency currents, provided the grid circuit is completed and the plate circuit is completed with a high voltage battery. The circuits are not completed in Fig. 18 because inductances, condensers, etc., in different combinations, frequently appear in the grid and plate circuits, and it is only desired to give some general circuits showing audio frequency reaction.

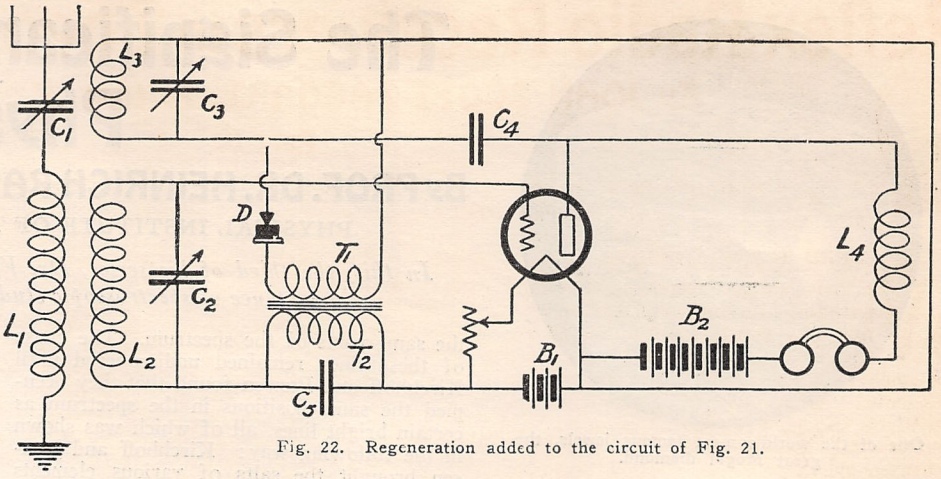



Fig. 22. Regeneration added to the circuit of Fig. 21.

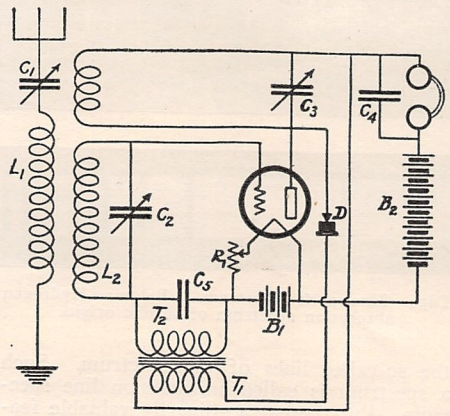



Fig. 19. The circuit of Fig. 17 with regenertion added.

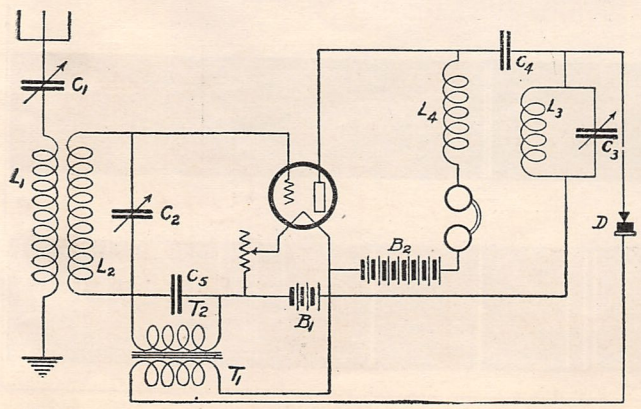



Fig. 21. A method of avoiding one of the troubles in the previous circuit.

In the arrangements of Fig. 17, it is quite possible that frequently the fundamental circuit of Fig. 18 is in existence and may lead to audio frequency oscillation. Actual inductive coupling, however, may also take place, the plate audio frequency circuit now consisting of the telephones T, the primary $T_1$, the completion of this circuit being formed by the capacity effect between $T_1$ and $T_2$. The audio frequency plate currents, for example, might flow through T, around through $T_1$, through the capacity between $T_1$ and $T_2$, back to the filament and so back to the left-hand side of T. We are not, of course, referring to any direct current, but only to the alternating potentials established across T.

### ADDING REACTION

The circuit of Fig. 17 will usually be found perfectly stable, but when feed-back is introduced, the possibility of audio frequency buzzing is greatly increased. Fig. 19 shows the arrangement of the circuit employing feed-back. Separate aerial tuning is still employed and is merely given here to prevent complications which arise when direct coupling is used. The object of these notes is to point out the various difficulties as they arise, and explain how they may be overcome.

It may be asked why the Fig. 19 circuit should tend to be more unstable than the arrangement of Fig. 17. There are several reasons: One of these is that as reaction is increased the tube tends to oscillate at radio frequency, and when this is done the audio frequency currents fed into the grid circuit tend to modulate these oscillations and produce an audio frequency feed-back chain containing a radio frequency link, as explained in Part 3 of this article.

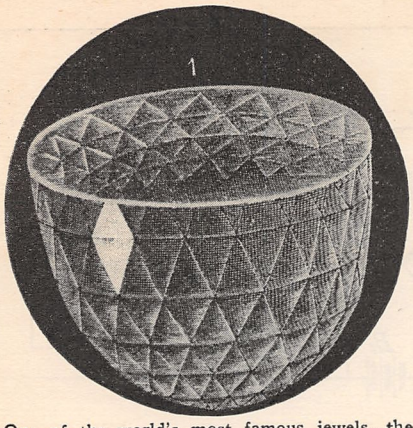
Another reason is that adding regeneration tends to increase the signal strength, and the feed-back will be greater. There is a tendency to increase any natural ordinary audio frequency regeneration. When no radio frequency is employed in a reflex circuit, there may always be present a slight audio frequency effect which is only waiting to erupt. The addition of regeneration and the increasing of the signals and the alteration of the general state of affairs in the tube frequently give an opportunity for the set to

(*Continued on page* 1543)

# The Significance of Rays In Physics

By PROF. DR. HEINRICH RAUSCH VON TRAUBENBERG
PHYSICAL INSTITUTE OF THE PRAGUE UNIVERSITY

*In this, the third of his series, Dr. Von Traubenberg discusses the extreme importance of spectroscopic studies in the work of the physicists.*



One of the world's most famous jewels, the great Mogul diamond.

## PART III

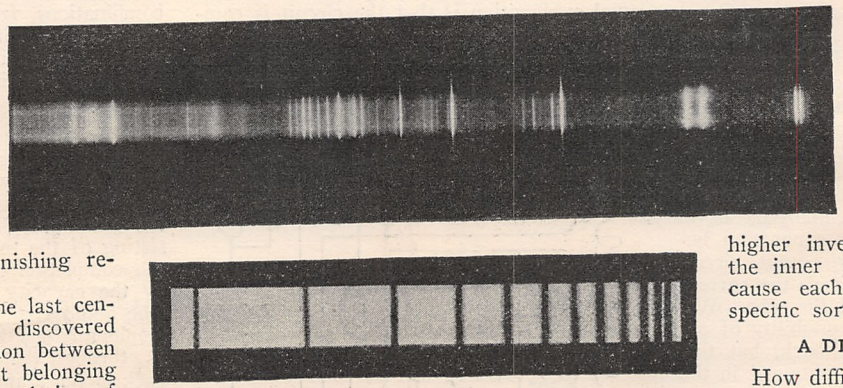
### DEVELOPMENT AND DESCRIPTION OF SPECTRUM ANALYSIS

IF in the preceding articles I have said that the study of electromagnetic radiations leads us to certain definite conclusions concerning the mysteries of nature and enables us to learn many things about the inner constitution of matter with exactness, we can guess at certain other things with a certain amount of assurance, I was especially alluding to modern spectrum analysis, which in this realm in recent times has shown the greatest and most astonishing results.

When in the middle of the last century Kirchhoff and Bunsen discovered the definite and fixed relation between a spectrum and the element belonging thereto, and thus laid the foundation of spectrum analysis, most physicists at once grasped the extraordinary import of this discovery. Directly after this spectrum analysis was developed by its discoverers into a powerful means of carrying out chemical and astronomical investigations. With this help the exact knowledge of material contents of the far distant stars was discovered and the most subtile analysis of a substance in the chemical laboratory was obtained. But that we should ever be able, by its help, to penetrate the interior of the atom was regarded up to the end of the last century as a fantastic hypothesis. But now our fantasy has become a reality, and the co-operation of several fortunate circumstances has brought about its possibility. As in all of these investigations, it was again an adequate investigator who would cover the entire field of view in the most thorough manner who was needed.

### REFRACTION

Snellius established the fact that a ray of light, that passes from a comparatively rarefied optical medium into a denser one, is subject to refraction in a very definite way. The circumstance of the light according to its color, that is to say, according to its wave-length, suffers a greater or less refraction. The so-called dispersion enabled the great Isaac Newton to show that the white sunlight was really due to the union of various kinds of light each of its own color. He passed the sunlight through a prism and obtained, in this way, the well-known spectrum of sunlight, which, like the rainbow, passes from red to violet, showing a constant shading of one color into another. A spectrum of this type we call a continuous spectrum. The celebrated physicist of Munich, Fraunhöffer, found that the continuous spectrum of sunlight was crossed by fine dark lines that always appeared on the same parts of the spectrum. The cause of these lines remained undiscovered until Kirchhoff and Bunsen found that they occupied the same positions in the spectrum as certain bright lines, all of which was shown in the following way: Kirchhoff and Bunsen brought the salts of various elements into the Bunsen flame, so as to evaporate them at high temperature. This gave the flame the color which was visible to the unaided eye. But in the spectroscope it was found that the light energy was not equally divided or distributed among the different individual colors, but consisted of certain very short bands of definite wave-lengths, the so-called lines of the spectrum. Such a spectrum is called an emission line spectrum. But the extraordinarily valuable feature of such a line spectrum is that every individual chemical element, whether in the pure and elemental stage or in combination, always shows its characteristic spectral lines in exactly the same places, which indicates that it always emits light of the same absolutely definite wave-length. On the other hand, if an incandescent gas is brought in the path of light of a very strong white flame, it will be seen that in the continuous spectrum dark lines show in exactly the same positions in which the lines of the emission spectrum of the incandescent gas would be. This shows, therefore, that a vapor when incandescent absorbs light of the same wave-length as it emits. From this we can conclude with certainty that the highly heated body of the sun emitting its continuous spectrum, is surrounded with cooler vapors of absolutely determined elements, familiar also to us on the earth, which by their absorbent power bring out the so-called Fraunhöffer lines in the otherwise continuous spectrum of the sun (Fig. 1).



Top: Zinc-spark spectrum. Below: Hydrogen absorption spectrum of cosmic origin.

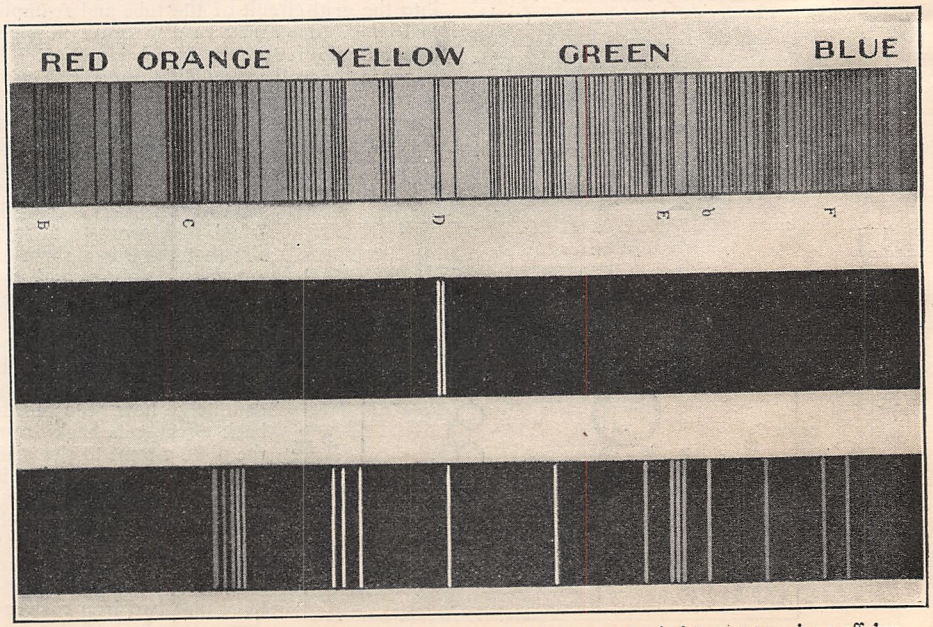
Modern investigation does not only satisfy itself with determining and measuring the line spectrum of each individual element, but also concerns itself with a much higher investigation, viz., to ascertain the inner physical foundations which cause each element to emit its own specific sort of light and no other.

### A DIFFICULT PROBLEM

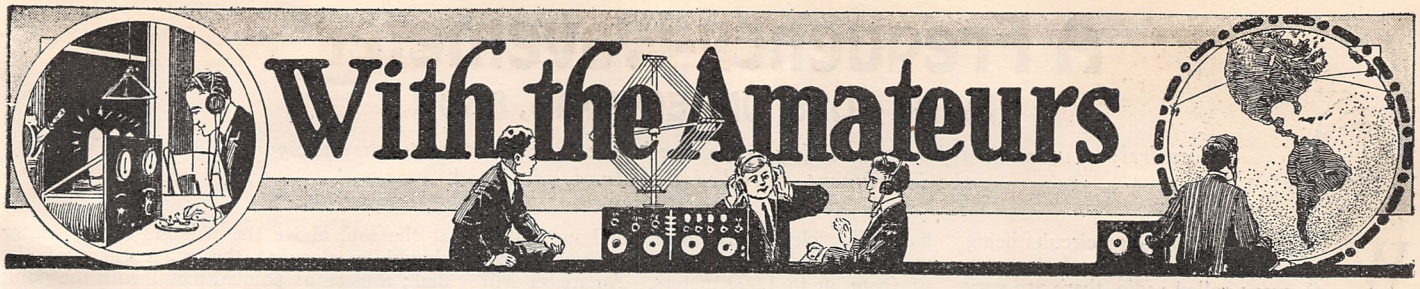
How difficult this investigation is, we can recognize when we observe the spectrum of the simplest of the elements, hydrogen. We see here a great number of lines which seem regularly distributed, also a number of apparently irregularly placed lines.

Many stars and nebulæ which send their light to us give us the well-known hydrogen spectra (Fig. 2) in an especially perfect form. To get the spectrum of such a substance as can only be evaporated with great difficulty

(*Continued on page* 1470)




Top: Absorption spectrum of the sun. The two lower bands are emission spectra given off by different substances examined. The location of the colors in the spectrum are shown at the top of the illustration.



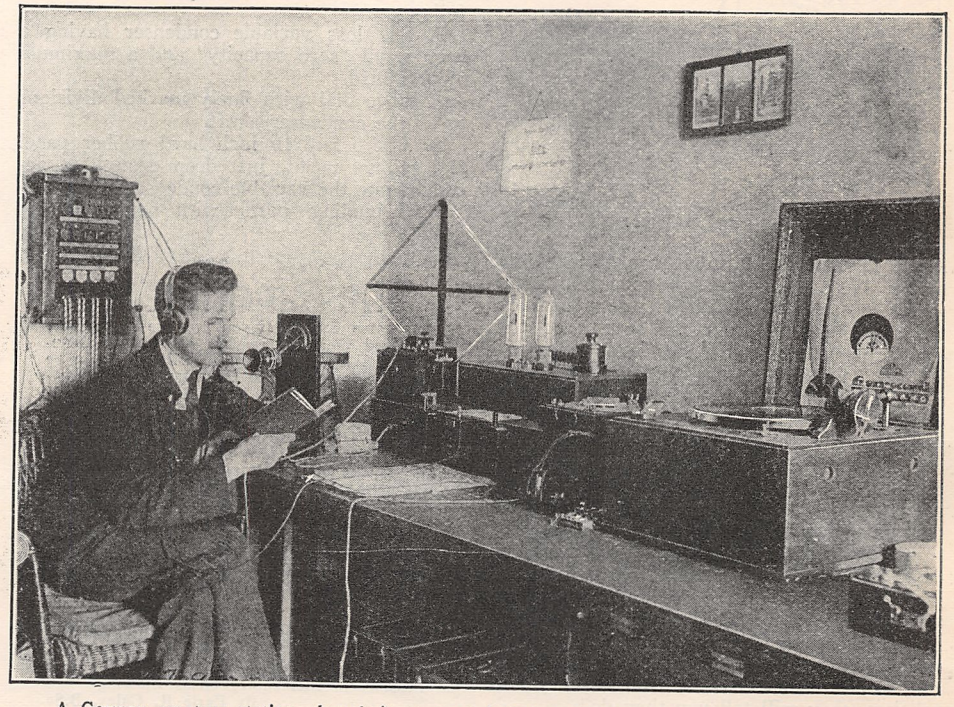

# Hamitorial

## The Blessing of Craftsmanship

IN the days of the Old Guild Workers, way back in the alleged Dark Ages, the master craftsmen had a saying to the effect that "God saw in the corners." This little dictum was recited to the apprentices at every opportunity. There was never a flagon of stout taken with the noonday herring that did not find it repeated, along with some tale of a particularly fine piece of work.

And what was the result? Simple. The stuff they made is selling for about seven times its actual value today because of its beauty, strength, utility and masterful craftsmanship. Their work was done as much for the love of the thing itself as for the mere cake and coffee which it brought. The workman was ranked by his work. If he was capable, he received the respect of his fellow men, when he discoursed on anything from crossword puzzles to the most efficient way of removing a hammer bruise from a finished cabinet, those around him stopped to listen. In other words, by his works he was judged—truly a most exact and profitable way of cross index filing the gentlemen of one's acquaintance.

And what is the situation now, me hearties? Just this. There are only a few places in which such a high ideal of workmanship still exists. There is one lone class of men who are still upholding the highest traditions of craft, one group who still strive to make their work really art, who do it for the thing alone. Let us crack a bottle of lemon sour to these noble gents, the amateurs and Hams of Radio.



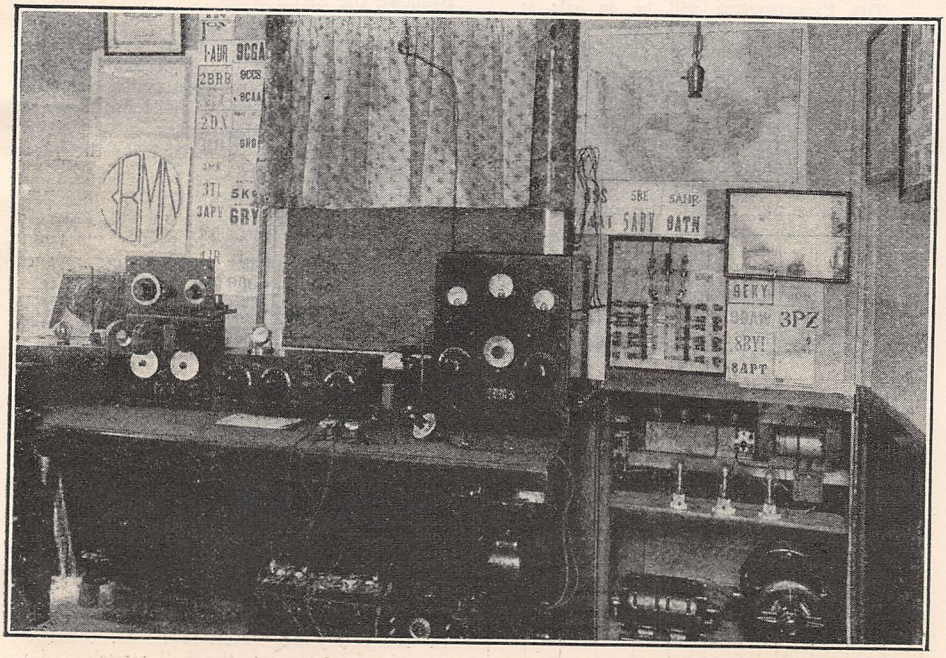
A German amateur station, though it may not look it. So far as we can make out, the full equipment consists of a low power fone transmitter and receiver. We take it that he supplies his listeners with canned music. © Kadel & Herbert.

Time was when the dim light of man working simply for the fun of it was sputtering and smouldering in the face of the heavy draft caused by the ease with which salable productions could get by. Machine and quantity production which is usually found in the commercial production in most mechanical lines, left little room for the fine craftsman. He was needed only in the tool room, and once the tools were assembled and chipped out, he usually had to take a place tending one of the tools he had made or else seek other employment. It was a bad prospect for the production of real mechanics, real engineers, engineers who knew their avocation from the ground to the chimney cornice. The idea of apprenticeship lasting over a period of years was made distasteful by the wages offered for tending one of the tool maker's machines.

Then came Radio. All the men who had almost forgotten the fun of working with their hands and brains immediately sought out the new field. It offered them many opportunities. The first and probably the largest was the opening of a field in which they could ferret out by sheer mental labor the foundational facts of a new science.

Then there was the necessity of building the apparatus. All parts and components of it were necessary, from the working model of the set to the extremely fine calibrating instruments with which they calculated the goodness or illness of their results. And there is the point

(*Continued on page* 1516)



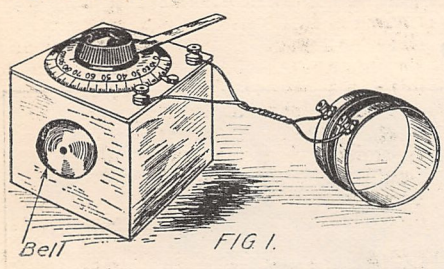

Station 3BMN, owned and operated by Raymond J. Carr, 617 Union Ave., Petersburg, Va. Although there is a fifty watter, the old standby is the five watt set which does most of the kicking out. This puts 2.5 amps into the antenna with a background of 600 volts at 75 mils. as the push. The receiver is a Grebe CR-13. 3BMN has been heard in 40 states, Hawaii, Panama, Cuba, Porto Rico and England.

# A Frequency-Wavemeter

## By De LOSS UNDERWOOD, 8BDR

*An entirely new method for ascertaining resonance in the use of wavemeters is incorporated in the instrument described by Mr. Underwood.*

WITH all the long-named circuits being used to receive the elusive electromagnetic wave called radio, there are very few sets which can be accurately calibrated to give a frequency or wave-length reading.




The appearance of the completed frequency-wavemeter ready for operation.

After interviewing a number of BCL's, the author has decided that a good call book should not give the wave characteristics of the stations, but rather the setting of the dials for a bunch of standard receivers. Those "operators" using Neutrodynes know that they must set their three large dials to a certain point, and after fussing with the rest of the controls a little, a definite station will make itself known via the loud speaker. That's all there is to it. Don't need to know the station's wave, just find out its program and listen for it at the times given. These fellows say that it's because their receivers are super-sensitive that they hear stations with sending ranges that are limited to a distance of 360 meters. Frequency is—well, look at their program, it'll tell you how often they transmit. And yet, they're classed as knowing radio. They do; ask 'em, they will tell you they do!

The receivers being built by the real radio experimenters of today from apparatus having low losses are the ones which will be getting the European concerts this year. The circuits will not have complicated coils and a multiplicity of tubes, but will be simple and easy to build. However, these tuners, which are on their way to popularity, must be built accurately and every unnecessary screw or turn of wire will have to be thrown out. Every variable condenser will be just large enough to cover the band of waves desired and every coil wound to reduce internal capacity and radio frequency resistance. The sets built by one very well-known radio firm have coils in them which choke the incoming wave and then make use of a great number of tubes to raise the current value to operate a sensitive loud speaker. It is to be supposed that the choking of the wave in the tuning coils softens the tones and gives more melodious music. This company sells their sets on the strength of their extremely beautiful cabinets, and their name. These complete outfits are said to be designed by the best radio talent in the world, men who have done the most to advance radio up to its present standing, and yet these men do not realize that the strength of a signal rests, to a great extent, in the tuner. It used to be good form to use No. 30 D.S.C. wire in any coil used with a vacuum tube, but "them days is gone forever," and the new tuners will have No. 18 or No. 20 D.C.C., and better signals, sharper tuning and greater satisfaction will be had.

In building and testing the coils for a tuner there will be no more useful instrument than the frequency wavemeter. The meter in use at this station is calibrated in both kilocycles of frequency and meters of wave-length. This meter has a wave range of from 20 to 1,000 meters. Amateurs will find use for one with 250 meters as a maximum, while BCL's, not being particularly interested in anything below 220 meters, should use the 220 to 550 meter band. The construction of the BCL meter is exceptionally simple and the required parts are as follows:

A low loss variable condenser having a very small "zero capacity" and a maximum of .001 mfd.

A large dial with finely marked divisions to fit the condenser shaft.

A 5 x 6 x 3/16 inch hard rubber panel and cabinet to fit, just deep enough to accommodate the variable condenser.

Two binding posts with non-removable heads.


## The Experimenter

has come back! If you are one of the one hundred thousand readers of the old ELECTRICAL EXPERIMENTER, you will no doubt be glad to hear that the EXPERIMENTER is coming back BIGGER AND BETTER THAN EVER.

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The Tauleigne Microphone Amplifier
Lessons in Elementary Glass Blowing
By Earle R. Caley, B.Sc.
Listening In For the Stars
By William Grunstein, E.E.
Heating Metals Under Water
By R. A. Goepfrich
Ball Lightning
Galvani and His Work

Be sure to reserve a copy from your newsdealer before the issue is sold out.

THE EXPERIMENTER will be on sale at all newsstands January 20, 1925.


A No. 50 honeycomb coil and six inches of flexible double conductor.

The cabinet is only to protect the variable condenser from dust and possible injury and to act as a support for it, while adjusting. Mount the variable condenser in the center of the panel with the binding posts at the top, above the pointer. The pointer should be close to the graduations of the dial; a piece of pointed metal with the point protruding slightly over the divisions on the dial is much more satisfactory than a mark on the panel.

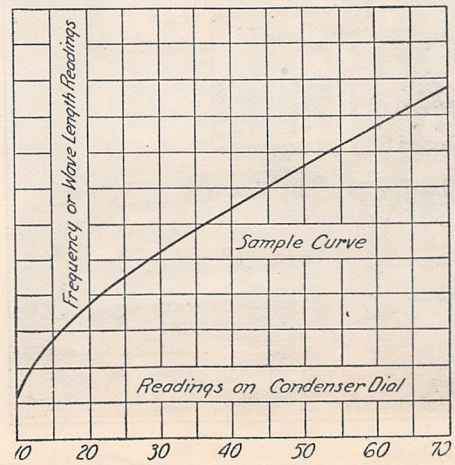



Fig. 3. A sample curve made from the frequency-wavemeter described in the present article.

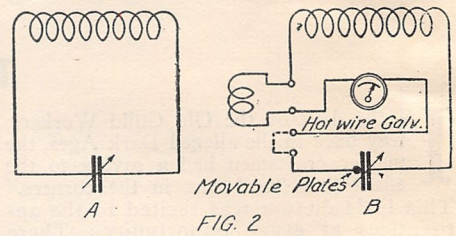



FIG. 2

A shows the hook-up of the frequency-wavemeter when used with receiver and B the circuit arrangement for use with transmitter.

Unwind about 10 turns from the honeycomb coil and solder the ends to the flexible conductor. This conductor may be of silk covered lamp cord with small clips or lugs with which to connect the coil to the binding posts of the condenser. Wind a little tape over the connections on the coil to make them firm.

For amateur work a larger panel and cabinet must be used to make room for a hot wire galvanometer or current squared meter. Two more binding posts should be added for this meter so that, if desired, the meter may be cut out of the circuit at will. (See Fig. 2.) Coils of No. 16 D.C.C. wire, five and 15 turns in the space of one inch, on three inch, untreated, cardboard tubes will cover the amateur bands very nicely. Calibration is had from standard wave tests from the Bureau of Standards station, using a short wave tuner. The click method is used: Each coil has leads of heavy wire extending from them which act as a support from the condenser; the coil is placed near the secondary of the tuner and tuned until there is a sharp click in the phones. This click is due to the break in oscillation. Remove the meter a short distance, until the oscillation ceases at a point and, on slowly continuing the motion of the meter dial, oscillation starts again. By carefully placing the meter, this point may be found to be less than a division in length. Then tune in to the standard wave, get it at the "zero beat" and turn the dial on the meter until the point of "click" is obtained. The meter is now tuned to the incoming wave and a point is determined on the graph of the condenser. If several points are found, the whole curve over the wave range desired may be covered.

The same method may be used by a BCL. It is difficult, however, to get broadcast stations on their "zero beat" and an easier method is advised. A small bell, like the one on a telephone box, is securely fastened to the cabinet of the condenser. (See Fig. 1.) The bell, when struck with a small rubber or felt hammer, will not be heard in the receiver when the meter is off tune, but when the coil is brought near the secondary of your tuner and the bell is kept ringing with light blows from the hammer, it will be heard when the dial on the meter is tuned to resonance with the tuner. When tuned to a definite known station, the wave-length or frequency of which is listed, the meter may be brought up, the bell struck and the condenser tuned until the note of the bell is heard along with the music coming from

(*Continued on page* 1494)

# Fundamental Transmission and Reception

## By E. H. HANSEN

*A very interesting article covering practical information on transmitting and receiving on the fundamental of the antenna proper and the advantages gained therefrom.*

STYLES in antennae have remained much the same since the first developments of Hertz and Marconi. A few variations such as the multiple tuned, the beverage, and combinations of different forms of antennae and counterpoises, are the only changes in 30 years. In the case of transmitting stations any efficient form of cage or flat top radiator with a corresponding ground or counterpoise was deemed sufficient. In the case of receivers, anything from the family clothes line, and a lead to the kitchen sink was satisfactory for the family's broadcasting entertainment.

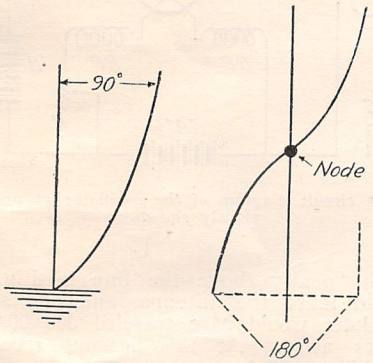
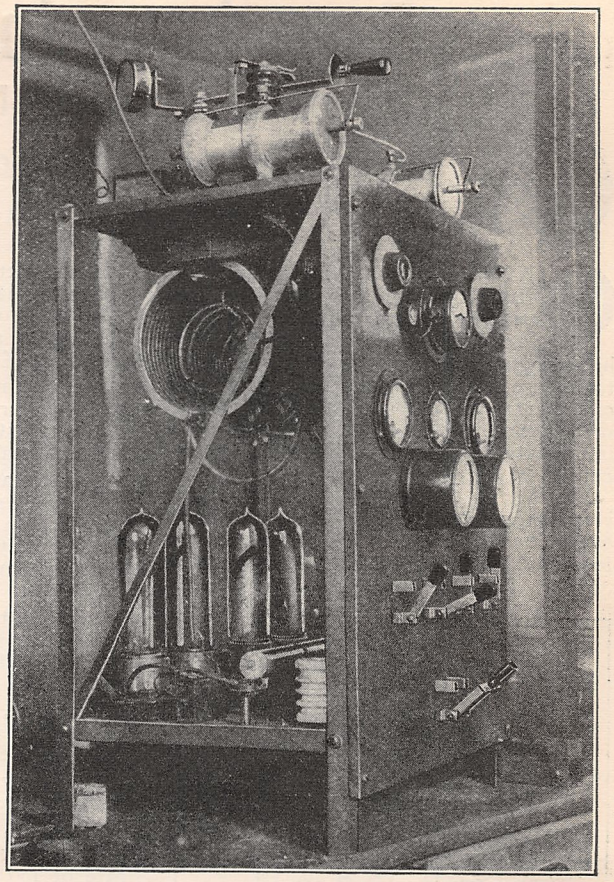



**Fig. 1 (left) A grounded antenna working at its fundamental has a period of one-quarter wave-length while an antenna employing a counterpoise (Fig. 2) has a period of one-half wave-length.**

Of course at the transmitting station it was known that any loss in the radiating circuit would cause a like decrease in the range. A few ohms more or less in a receiving antenna do not produce a noticeable loss; however, it may mean success or failure at the transmitting station. While this article may be of interest chiefly to the man with a transmitter, its practice may be applied equally as well to the receiver.

When an antenna is connected to a transmitter using a ground, it has a period of vibration of one-quarter wavelength if worked at its fundamental. This is shown in Fig. 1.

In this case the grounding point is also the nodal point, or that part of the radiator where no current is flowing. The use of a ground permits, theoretically, the propagation along the surface of the earth, true wave form. In practice certain losses become apparent when trying to force large amounts of current into the earth. A large contact surface becomes a necessity, and in certain geographical locations it is impossible to make contact with damp earth.



**A view of Mr. Hansen's 90 meter fundamental transmitter. The inner coil of the O.T. in back of the panel is the antenna coupling coil.**

In order to overcome this difficulty, the counterpoise was devised. By the use of proper conductors the losses of poor grounds were compensated for in the counterpoise and an efficient radiating circuit became available regardless of rocky or sandy terrain. In the case of the antenna and counterpoise the circuit has a period of one-half wave-length at its natural or fundamental vibration. This is shown in Fig. 2.

The natural period of an antenna is always increased by the addition of a ground or counterpoise. A ground gives a slightly greater fundamental. There are many theories as to wave form and travel from various types of radiators. The following are some of the results obtained at 2XAY using true fundamental transmission. It is believed that this is the first station to use this method over distances of several thousand miles. By actual comparison with the same transmitter accurately tuned to the usual antenna and counterpoise, it was possible to obtain greater received signal strength, watt for watt.

The use of the higher frequencies permits fundamental transmission without large amounts of ground room. In the case of 2XAY the work was carried out on a wave-length of 90 meters.

In Fig. 3 we have a radiating circuit of these dimensions. The transmitter employs, in the closed circuit, a standard self rectifying Hartley hook-up. It is in the open or radiating circuit that the changes have been made. Instead of counterpoise or ground as usual, both have been left off. Instead of sending current into a non-working portion of the radiating circuit, it is kept in the antenna and the full power is actually radiated into space

Any transmitting circuit can be utilized without change. Simply build an antenna (single wire preferred here) to the exact length in meters that you desire to transmit

(*Continued on page* 1448)

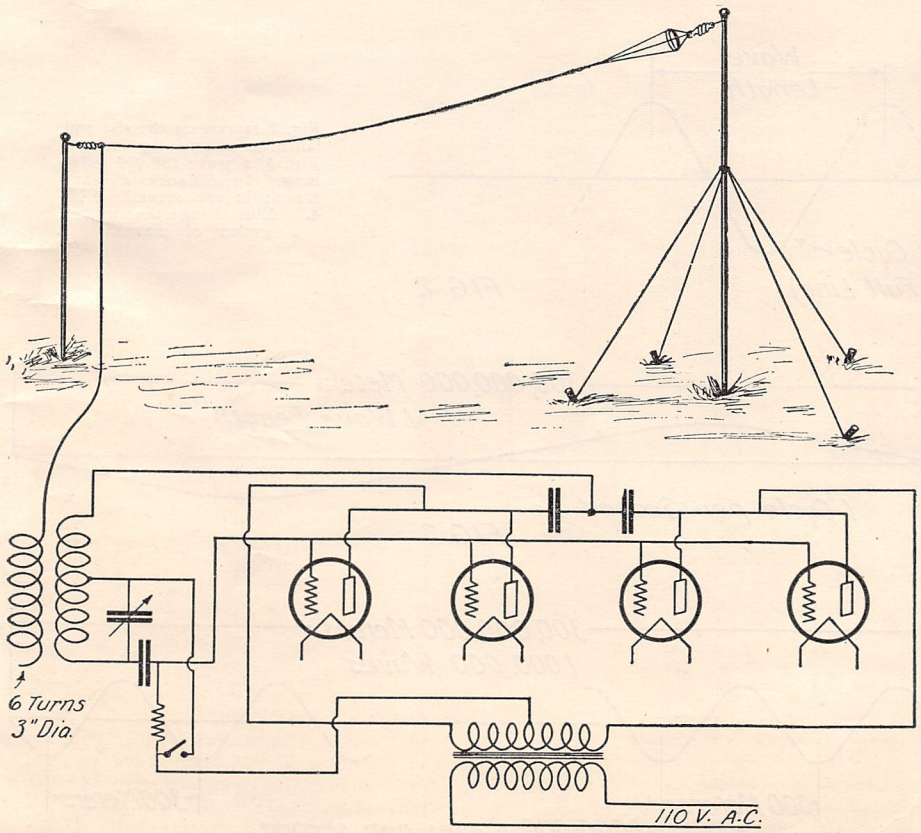



**Fig. 3. The circuit diagram of the fundamental transmitter. The antenna from the far end to the connection at the coupling coil is 90 meters long. The closed circuit is tuned to 90 meters. Note the absence of the ground connection.**

# Experimenting with Five Meters

By WILLIAM A. BRUNO, A.I.E.E.

*This is the second of a series of articles by Mr. W. A. Bruno in which he goes further into the details of construction, method of wave-length measurement and control of the 5-meter transmitter described in the January Issue of "Radio News."*

ONE of the most important factors to take into consideration when building a C.W. transmitter for experimenting on very high frequencies is the length of the wires to be used for interconnecting the various parts, and the elimination of all metals, not part of the circuit, from the immediate vicinity of the oscillating circuit.

The length of the connecting wires is very important for two reasons. First, every inch of wire introduces resistance losses. Second, if you use any more wire than is absolutely necessary, you are apt to be disappointed when you measure the wave-length of your set, as described in this article. You will remember how, in the first article, we described an experiment in which we absorbed the whole output of the transmitter with a small closed loop of wire, held near the oscillator coils. This should prove to you the bad effect of any unnecessary metal parts anywhere in or near the transmitter.

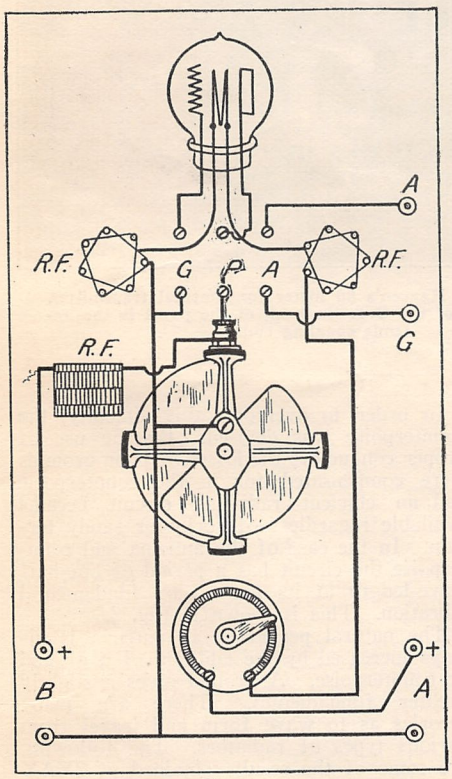



FIG. 1

**Panel layout of the 5-meter oscillator. Note the small radio frequency choke coils.**

Fig. 1 is a layout of the rear of the panel. While other experimenters have suggested more compact forms, a great deal of appearance has been sacrificed, and we believe that this arrangement pleases the eye, while it is electrically efficient.

The coils marked R.F. in Fig. 1 are the three radio frequency chokes as described in the previous article. The tuning condenser and rheostat are shown and A, P, and G are the antenna, plate and grid inductance terminals.

In the set built by the writer, provision was made to vary the coupling between the coils, but no use was made of this feature and at this writing these coils are about ½ inch apart.

We assume that with the information given so far you have been able to build this interesting outfit and are operating it successfully.

You certainly are wondering how these short waves may be measured. It is a well-known fact that these waves (and theoretically all radio waves) may be accurately measured with the ordinary yard-stick.

This statement seems amazing; still, it is very easily understood, once the theory of the travel of radio waves is considered.

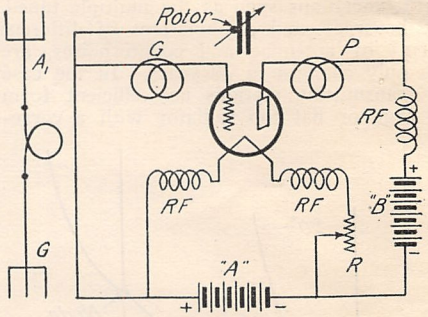
Basically, what we call radio, is an alternating current oscillating at a very high frequency.

We may represent the "rises" and "falls" of this high frequency alternating current in the usual manner. (Fig. 2.)

We know that electricity travels at the rate of 186,000 miles per second, or 300,000,000 meters. (Recent experiments seem to prove that radiated waves travel at a somewhat lower speed; but as the experts still disagree about the new figure, all calculations at the present time are based on the old standard.)

Now we will draw a line (Fig 3) and assume that it is 300,000,000 meters long, or 186,000 miles. (The distance ether waves travel in one second.)

Now assume that we are producing alternating current at a frequency of one cycle per second, and that this current is being radiated from an antenna.




**The circuit diagram of the oscillator as previously shown.**

Each "peak" above the line in Fig. 3 would leave the antenna, and one second later would have traveled 300,000,000 meters away. At this instant, another "peak" would leave the antenna, traveling 300,000,000 meters behind the first one. The wave-length, or distance between these high spots as they travel away from the antenna, would then be 300,000,000 meters.

Then let us assume that we are able to increase the frequency of our transmitter until we are sending out 1,000,000 cycles, or 1,000 kilocycles in one sec-

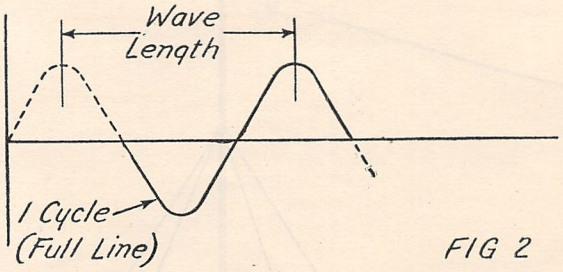



FIG 2

**Fig. 2 represents the rise and fall of an alternating current, Fig. 3, a wave 186,000 miles long, the distance a wave travels in one second. Fig. 4. Illustrating the propagation of waves.**

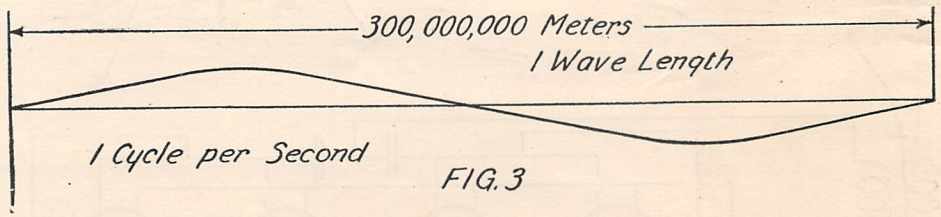



FIG. 3

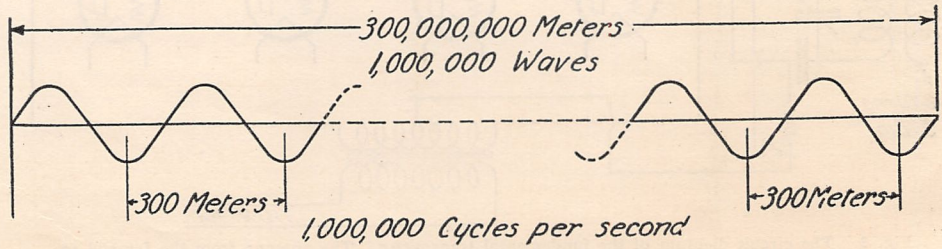



FIG. 4.

ond. Fig. 4 shows a line which we imagine to be 300,000,000 meters long (distance covered by ether waves in one second).

At this frequency, or any frequency, each wave still travels 300,000,000 meters away from the transmitter in one second. During this one second 1,000,000 more waves have left the transmitter, following the first wave. The distance from wave to wave, or the wave-length, then equals 300,000,000 meters divided by 1,000,000 waves, or 300 meters. By increasing the frequency of the C.W. transmitter, the waves leaving the antenna are crowded closer together, and the wave-length is shorter. Since 300 meters corresponds to 1,000,000 cycles per second, we can write the following formula for frequency:

$$F = \frac{300,000,000}{M}$$

Where F is the frequency and M the wave-length in meters.

In our case, we are mainly concerned with the 5-meter waves and therefore show on Fig. 5 a hypothetical curve of a current oscillating at this frequency.

By referring to Fig. 5, you will note that at every 2½ meters the voltage of the transmitted energy drops to zero potential.

Now, then, if these waves could be made to stand still long enough for us

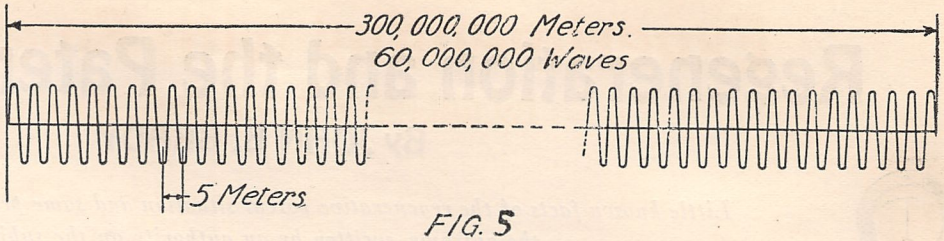



FIG. 5

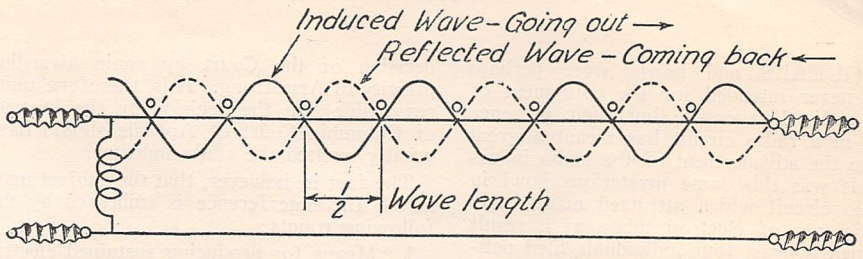



FIG. 6

Fig. 5. A series of waves each five meters in length. 60,000,000 of them leave an aerial in one second. Fig. 6. Illustrating the reflection of a wave along a wire.

to pick out the spots where the voltage was zero we could measure the distance from one zero-point to another, and get the wave-length with the famed yard-stick. Fortunately, such a method has been discovered, and takes its name from its inventor, Lecher.

Before describing this very interesting method of measuring short waves we must delve again into the theory of oscillating currents.

If a C.W. oscillator is connected across a pair of parallel wires, carefully insulated, a wave will travel down the wires, and when it reaches the far end will be reflected back again. The result is shown in Fig. 6.

The zero point of each wave going out always will meet the dead point of some other wave coming back, at the points marked "O." At these points the voltage of the wave going out is always equal, but opposite to, the voltage of the reflected wave coming back. The result is that there is always zero voltage at the points "O," all of which are one-half of a wave-length apart.

We are now ready to undertake intelligently the measurement of the waves generated by our miniature transmitter.

Run two parallel wires, about 25 feet long, across the room, 6 inches apart, and stretch them as tightly as possible. Attach good insulators at the ends of the wires and connect the two near ends to an Ultra-Vario condenser on which two single coils of wire 3 inches in diameter are mounted. (Fig. 7.)

Obtain from an auto supply store a spark plug tester, costing about $1.00,

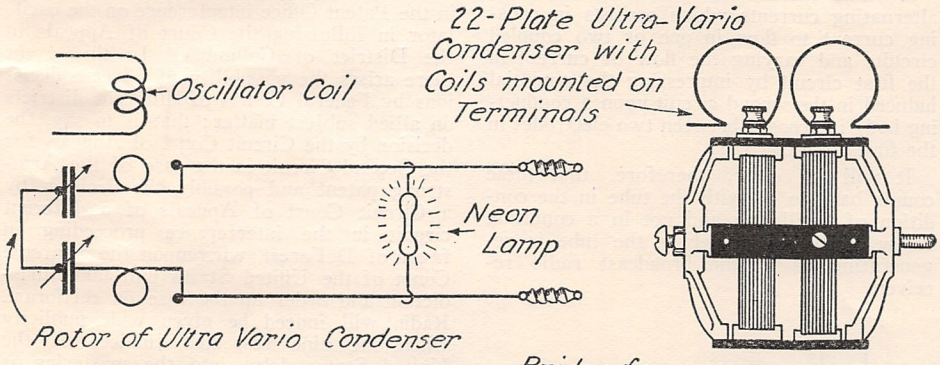



FIG. 7




FIG. 7A

Fig. 7. Circuit arrangement employed for measuring the wave. Fig. 7A. Showing how the wire is bent to make a bridge.

and remove the little lamp from its casing, being careful not to break the wires nor to injure the lamp.

This lamp is filled with neon gas and has the property of glowing when a high frequency oscillation is applied to it. Place this lamp across the two wires and get the transmitter to oscillate. When the milliammeter shows maximum radiation, carefully adjust the condenser in series with the long wires. When it is in resonance, the neon lamp will light up.

If you notice that the circuit is in resonance by the deflection of the milliammeter and the bulb does not light up, move it forward until it lights.

Leave the bulb at the point on the wire where it seems to light up brightest. Now take two pieces of wire and shape them into a "bridge" as shown on Fig. 7A. Place one of these bridges on one side of the lamp and move it back and forth with a long insulated rod to a point where the short-circuiting of the two long wires will have no effect on the lamp. Now place the other U-shaped wire on the other side of the bulb and move it until the little lamp will merrily light up.

By referring to Fig. 8 we will see what is happening.

The lamp is at a point where the voltage of the waves is at its maximum, and the bulb glows brightly. The little bridges are at points where the voltage is zero, and consequently there is no tendency for current to flow across, and no energy is absorbed by the bridges. The neon lamp absorbs very little energy, and does not affect the relation between the outgoing wave and the reflected wave. If you now take your yard-stick (ruled in metric system; or 1 meter=39.37 inches) and measure the distance between the two short-circuiting wires, you will have exactly one-half of the wave-length of the oscillations in the wires. By applying the formula given before, you will be able to obtain the frequency at which your transmitter is operating.

It is very simple now to calibrate your transmitter condenser by repeating the

(*Continued on page* 1551)

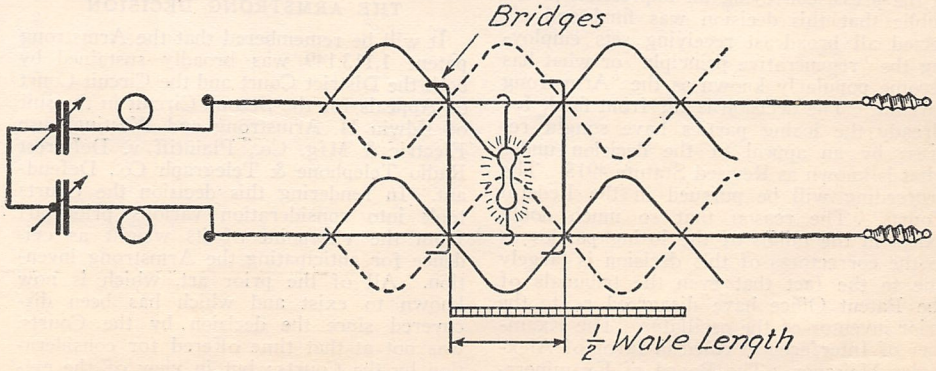



FIG. 8

It will be seen from this illustration that the lamp is at a point of maximum voltage, the peak of the wave; and the two wire bridges at points of zero potential.

# Regeneration and the Patent Situation

By JOHN B. BRADY*

*Little known facts of the regenerative patent situation and some probabilities relative to the outcome, written by an authority on the subject.*

SQUEALS and howls were perhaps never intended for the enjoyment of radio listeners-in, but their presence in a radio circuit has meant a great deal to the advancement of the radio industry. It was this same mysterious howl in a radio circuit which attracted many early investigators of electron tubes, as a result of which at least four individuals filed petitions with the Commissioner of Patents at Washington, D. C., each praying that a patent be granted to him for the discovery of the electron tube as a generator of oscillations. These four investigators were: Edwin Armstrong, Lee DeForest, Irving Langmuir and Alexander Meissner. Under the rules of the United States Patent Office only one patent may be granted for the same invention, so that the applications of these four parties were declared to interfere with each other and proceedings were instituted to determine the first inventor.

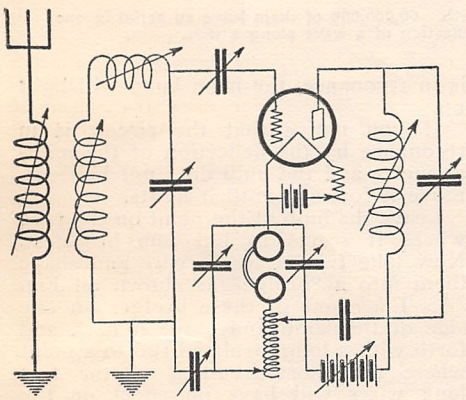


Fig. 1

Armstrong regenerative circuit with plate tuned by shunted capacity and inductance.

### CASE DECIDED RECENTLY

It was this interference proceeding which was recently decided by the Court of Appeals of the District of Columbia, in which the Court ruled that Lee DeForest should be credited with the invention of the tube as an oscillator. This news swept the radio industry by storm. The meaning of the decision was in many instances misinterpreted in the press, conveying an impression to the public that this decision was final and effected all broadcast receiving sets employing the "regenerative principle" or what has become popularly known as the "Armstrong Circuit." The decision is far from final, for already the losing parties have sought redress by an appeal of the decision under what is known as Revised Statute 4915. The proceeding will be pursued in the Federal Courts. The reason that so much doubt exists in the minds of the losing parties as to the correctness of this decision is largely due to the fact that even the tribunals of the Patent Office have disagreed as to the prior inventor of the oscillator. The Examiner of Interferences ruled in favor of Alexander Meissner. The Board of Examiners-in-Chief reversed this decision and ruled in favor of Armstrong. The Commissioner of Patents was appealed to and sustained the decision of the Court by again awarding priority to Armstrong. It is, therefore, quite reasonable that the decision by the District of Columbia Court of Appeals should have greatly excited the radio industry.

The fact is, however, that the subject matter of this interference is embraced by the following counts:

1. Means for producing sustained electrical oscillations comprising an oscillatory circuit having two electrodes in an exhausted receptacle and a second circuit coupled thereto having a conducting body interposed between said electrodes.

2. Means for producing sustained electrical oscillations comprising an oscillatory circuit having two electrodes, a second circuit coupled thereto having a conducting body interposed between said electrodes, and means for varying the frequency of the produced oscillations.

3. The method of producing electrical alternating currents which consists in causing current to flow in one or two coupled circuits and varying the flow of current in the first circuit by impressing the potential induced in the second circuit upon a conducting body interposed between two electrodes in the first circuit.

It will be clear, therefore, that these counts have to do with the tube in the condition of oscillation and not in a condition below oscillation or where the tube is regenerating as in the broadcast radio receiver.

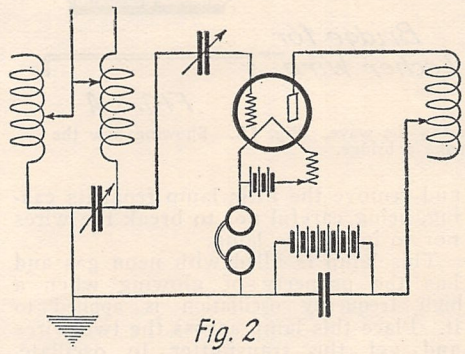


Fig. 2

Armstrong regenerative circuit having telephone receivers connected in both the input and output circuits with plate tuned by inductance.

### THE ARMSTRONG DECISION

It will be remembered that the Armstrong patent 1,113,149 was broadly sustained by both the District Court and the Circuit Court of Appeals for the Second Circuit in the suit of Edwin H. Armstrong and Westinghouse Electric & Mfg. Co., Plaintiff v. DeForest Radio Telephone & Telegraph Co., Defendant. In rendering this decision the Courts took into consideration various prior art from the viewpoint of its weight as evidence for anticipating the Armstrong invention. All of the prior art, which is now known to exist and which has been discovered since the decision by the Courts, was not at that time offered for consideration by the Courts; but in view of the evidence then in the record the Armstrong patent was broadly sustained. The Court went even further than merely awarding the regenerative circuit to Armstrong by interpreting the invention with such scope that even a tube in the condition of oscillation would be embraced by the Armstrong invention—that is to say, a tube which is oscillating was considered to be inherently regenerating or feeding back energy from the plate circuit to the grid circuit, although perhaps in a greater degree than would be the case when the tube is regenerating at a point below oscillation. The Court accepted as a definition of the Armstrong invention "any arrangement by which oscillating current energy is transferred from the output or plate circuit of the audion to the input or grid circuit to sustain the oscillations in the grid circuit is included in the principle of the Armstrong invention."

The radio industry may yet hear the Supreme Court of the United States act upon the question of regeneration and oscillation in electron tubes. This may come about by a decision by the Federal Courts in the Patent Office interference on the oscillator in following the Court of Appeals in the District of Columbia. In this event there arises the possibility of adverse decisions by Federal Courts of different districts on allied subject matter; that is to say, the decision by the Circuit Court of Appeals for the Second Circuit in the case of the Armstrong patent and possibly the decision by a Circuit Court of Appeals of a different circuit in the interference proceeding in favor of DeForest, whereupon the Supreme Court of the United States will take jurisdiction and order up the case on certiorari. Radio will indeed be given wide publicity when the nine respected justices of the United States delve into the mysteries of this art.

### THE ARMSTRONG CIRCUITS

The Armstrong patent contains six different wiring diagrams for a radio receiver. They have been reproduced in Figs. 1 to 6, inclusive: In Fig. 1 the radio receiver is shown with the plate circuit tuned by a second inductance and capacity. The telephone receivers are placed in a common path in the input and output circuit so that the circuits are linked and will produce a feedback of energy from the plate circuit to the grid circuit, reinforcing the incoming energy and producing a greater volume in the telephones. In Fig. 2 Armstrong showed an arrangement for a receiver in which the plate circuit is tuned by an inductance and the telephones are in a path common to the input and output circuits for producing the

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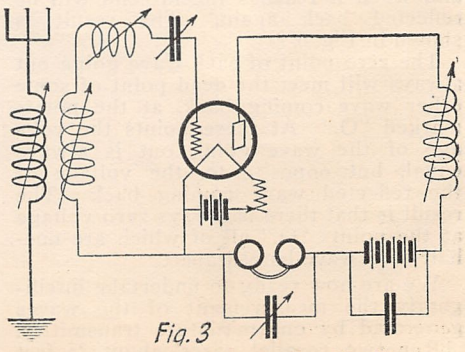

Fig. 3

Armstrong regenerative circuit with plate circuit tuned by inductance.

*Patent Lawyer, Ouray Building, Washington, D. C.

# The Nature of High Frequency Resistance and Its Effect in Multi-Layer Coils

**By SYLVAN HARRIS, Consulting Engineer**

*The second article by Mr. Harris, dealing with the effects of high frequency currents in coils of varying types and characteristics. The present article covers coils of the multi-layer type.*

BEFORE going into the subject of this article, it will be well to give an explanation of the whys and wherefores of skin-effect in conductors, such as wire with which the coil is wound, and explain why the skin-effect raises the apparent resistance of the conductor or coil. This explanation was omitted from the previous article by the writer for lack of

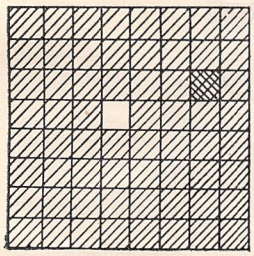

Fig. 1. Illustrating the unequal distribution of a radio frequency current in an uneven conductor.

space, and the discussion applies as well to that article as to this.

The ordinary resistance of a conductor may be calculated by the formula:

$$r = \rho \frac{l}{a}$$

when the path of the current flow is known, and the cross-section of conductor traversed by the current is uniform. Moreover, the *distribution of current* throughout the conductor must be *uniform,* that is, every square inch or square centimeter of the cross-section of the conductor must carry the same amount of current. In this formula, r is the resistance of the conductor, $\rho$ its resistivity or specific resistance, l its length, and a its cross-sectional area at right angles to the direction of flow of the current.

### SKIN-EFFECT

If, however, the distribution of current throughout the conductor is *not uniform,* these simple relations do not hold. This can easily be understood from the following discussion. Imagine that a cross-section of conductor, supposed square, is divided into elements of area, and that each filamentary conductor has the same resistance and carries the same fraction of the total current. (Fig. 1.) The equality of the currents in each filamentary conductor is indicated by the equal shading in the small squares of the figure.

Now imagine that the current in one of the filaments is removed and added to the current in another. The total current in the entire conductor is not altered, but the heat generated in the first named filament becomes zero, for it now carries no current, and that generated in the second filament becomes *four* times as great. This, because the heat generated is proportional to the *square* of the current. Accordingly the total heat generation is increased, although the total current was not altered. From this it can be seen that any distribution of current in a conductor that is not symmetrical results in a resistance higher than that for a uniformly distributed current.

The next thing to be considered is: What is it that causes asymmetrical current distribution in a conductor? It occurs only under the action of alternating currents, and becomes appreciable only when the frequency of the current becomes very high, more particularly in the radio frequencies. The current is forced from the center of the conductor and is made to travel near and on the surface. In round wires of ordinary diameter at radio frequencies, the current may penetrate into the body of the conductor only as deep as .001 millimeter.

The reason for it is found in the variations of the magnetic field set up by the high frequency current flowing in the conductor. The interior parts of the wire are linked by more lines of magnetic flux than are the parts nearer the surface of the wire. Hence the self-induced voltages near the center of the wire are greater than those near the surface, and are in a direction opposed to the direction of flow of the current. The current, therefore, receives greater opposition near the center. As a result it creeps toward the surface of the conductor.

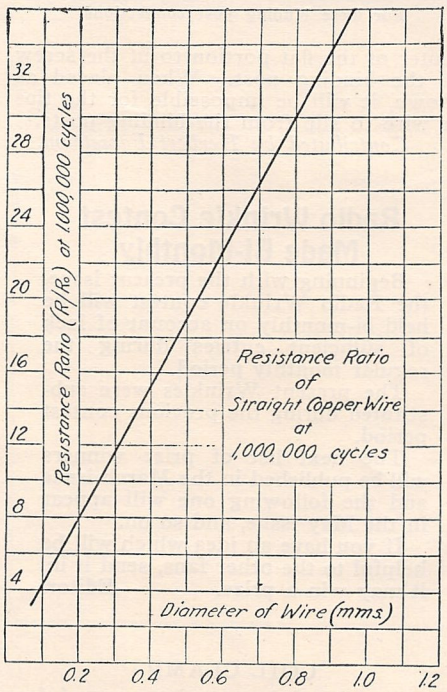


Fig. 3

Resistance, as defined above, for the uniformly distributed current is known as the ohmic resistance, which depends only on the nature of the conductor and its dimensions. The *effective* resistance of a conductor, however, may be very different from this value, since it depends upon the amount of heat generated in the conductor. It follows, then, that the effective resistance of a conductor "suffering" from skin-effect may be many times the ohmic resistance, and such is the case. The magnitude of the skin-effect is spoken of as the ratio of the effective resistance at high frequency to the ohmic resistance (at zero frequency), or in symbols, $R/R_0$.

The magnitude of this effect depends mostly on the dimensions of the conductor. Small wires have less skin-effect than large ones, although their ohmic resistance is considerably greater. Skin-effect also exists to a marked degree in flat conductors, such as strips or tapes. There is no doubt that it also exists in condenser plates.

Very exact formulae are available (Rosa & Grover, Bulletin Bur. of Stds., Vol. 8) for calculating the high frequency resistance of straight wires, and from these formulae the curves shown in Fig. 2 were computed. It is interesting to note that the skin-effect is generally greater for the larger wires than for the smaller. Furthermore, the resistance ratio increases steadily with the frequency. The ratio for very small wires differs little from unity, meaning that their resistances do not change very much with the frequency. This is the reason why very fine wires are used as standards of resistance for high frequency measurements. The resistance of No. 32 wire does not change more than about 10 per cent. over a range of 1,000 kilocycles.

### HIGH FREQUENCY RESISTANCE

In determining the actual high frequency resistance of wires or conductors, all that is necessary is to obtain the D.C. resistance and multiply it by the resistance ratio. Thus, if No. 14 wire has a resistance to direct currents of 2.5 ohms per thousand feet, and (see Fig. 2), its resistance ratio is 6.4 at 1,000 kilocycles (1,000,000 cycles), the resistance of the wire at 1,000,000 cycles will be

$2.5 \times 6.4 = 16$ ohms per 1,000 feet.

This, of course, is for a straight wire insulated in space, so that there are no losses through insulating materials, and, moreover, is sufficiently removed from other conductors or circuits so that there is no transference of energy from the one to the other through the coupling between them.

It is interesting to note that if the resistance ratios for a given frequency, say, 1,000,000 cycles, be plotted against the wire diameter, we shall obtain a straight line relationship, as shown in Fig. 3.

This may not be an exact straight line, but it may be considered straight for all practical purposes. Making this assumption it can be shown that the resistance ratio at 1,000,000 cycles is related to the wire diameter by the approximate formula

$$\frac{R}{R_0} = 37.8\ D + 0.3 \text{ (diameter in cms.)}$$

This simple relation can be utilized in obtaining an expression which will give the high frequency resistance per foot of wire

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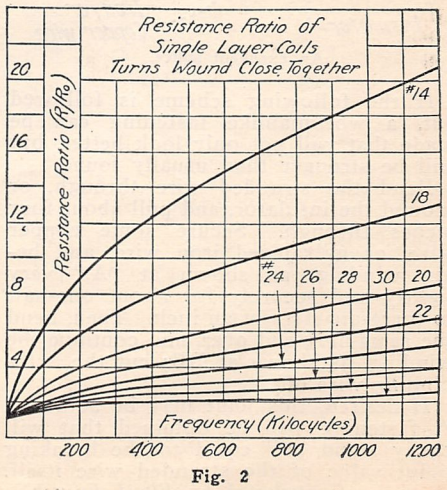
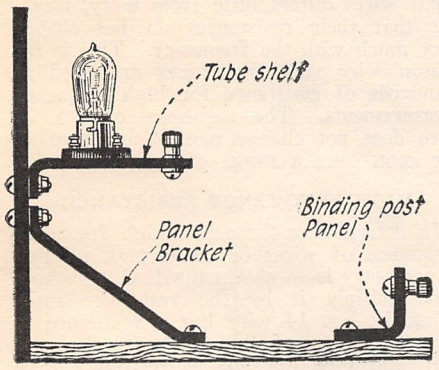



Fig. 2

# Radio Wrinkles

## WORKING HARD RUBBER

Hard rubber, when heated in boiling water becomes quite soft and pliable. The easiest way to cut a piece of this material is to place it in a utensil so that it may be totally covered with water and allow the water to boil just long enough for the rubber to soften so it may be bent with the fingers. If the rubber is allowed to remain in the water too long it will become so soft that the marks of the fingers will spoil the smoothness of the article. Heat a sharp knife to the same temperature as the rubber, by placing it in the same water. When the rubber has reached the proper stage, lay it on a flat surface and, with a ruler as a guide, cut along the desired line with the knife.



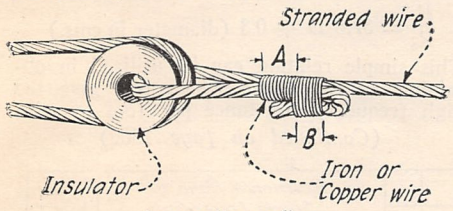

Uses for scrap rubber.

Hard rubber also may be easily bent to any desired shape if it is first heated. In the accompanying illustration are several brackets that are made by bending rubber when hot. After the rubber has been bent, dip it into cold water so that it will cool quickly and will not bend out of the shape wanted. Rubber after being treated in this manner will return to its usual hardness when cooled.

*Contributed by Wm. King.*

## FASTENING STRANDED WIRE

There are quite a few listeners-in who use stranded wire for their aerials, or possibly for the guy wires. Those who have tried to fasten this kind of wire to insulators or other supports have found that it is a difficult thing to secure a satisfactory and neat job.




An excellent splice.

If the following scheme is followed out, a workmanlike fastening can be made that will not only look better, but will be stronger than usually found.

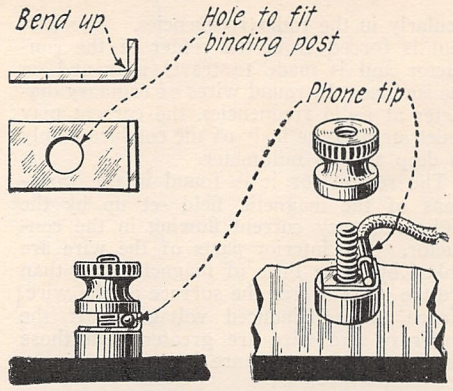
Bend the stranded wire through, or around the insulator, and pull about four inches through. Secure some copper wire, or galvanized iron wire, and begin winding, as shown at "A," very tightly and securely for about one-half to three-quarters of an inch. Then, bend the remaining end over, and continue the winding, as shown at BB; cut the extra binding wire off.

If desired, this joint may be soldered. A fastening will be obtained that will easily stand pull equal to the breaking point value of the stranded wire itself.

*Contributed by Floyd French.*

## DEVICE FOR HOLDING PHONE TIPS IN BINDING POSTS

Here is a handy little idea to keep phone tips and large solid wire tight in binding posts. Bend a piece of thin sheet copper, brass or tin, as shown in the accompanying sketch. Drill a hole in the




For loose binding post connections.

center of the flat portion to fit the screw of the binding post. When placed as shown, it will be impossible for the tips or wire to slip from the binding posts.

*Contributed by Herbert Forsstrom.*

## Radio Wrinkle Contest Made Bi-Monthly

**Beginning with the present issue, the Radio Wrinkle contest will be held bi-monthly on account of lack of sufficient entries during the regular monthly period.**

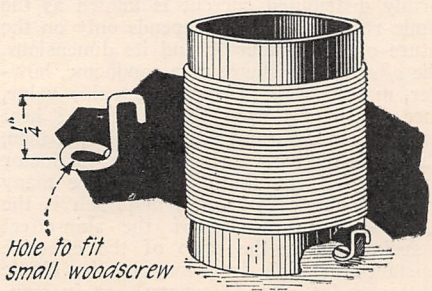
**The present Wrinkles were substituted during the previous contest period.**

**The next list of prize winners will be published in the March issue and the following one will appear in the May issue, and so on.**

**If you have an idea which will be helpful to the other fans, send it in, it may win a prize. —Editor.**

## COIL CLAMP

An easy and inexpensive way of fastening coils firmly to the baseboard without using brackets or bolts is illustrated in the accompanying sketch. Cut a piece of bus-bar or round wire (about No. 14 or 16) 1½ inches long. Bend a loop in one end of the wire to fit a small wood screw and then turn the straight part of



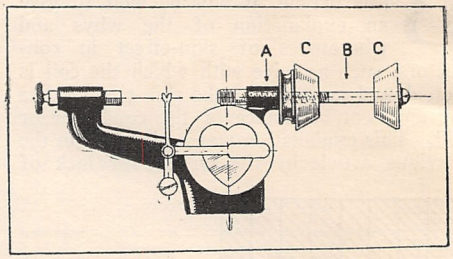

A coil clamp easily made.

the wire at right angles to the loop. Form a hook in the straight part, which passes through a hole drilled in the tube about ¼ inch from the bottom. The coil may then be placed on the baseboard and fastened down by using a wood screw through the loop in the clamp.

*Contributed by T. J. Brant.*

## AN EXCELLENT COIL WINDER

Any sewing machine bobbin winder similar to the one shown in the sketch may easily be made into a very satisfactory and rapid coil winder by simply drilling and tapping a hole as indicated at A for the screw B, which acts as a mandrel or arbor. Cones C may be made of either wood or metal and slip over the screw.




Sewing machine bobbin coil winder.

To operate, place the core on which the coil is to be wound on these cones and tighten the screw. Several different size cones may be made and also several different lengths of screws, to accommodate coils of different sizes.

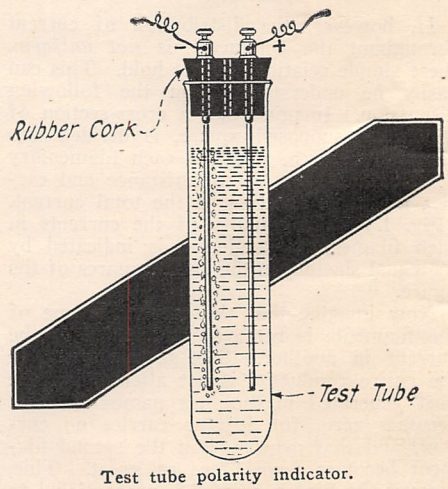
If care is taken in drilling and tapping the hole A central, a smooth running winder will result.

*—Contributed by Chas. M. Otis.*

## A SIMPLE POLARITY INDICATOR

The materials needed for this polarity indicator are a test-tube, rubber cork, two binding posts, about 12 inches of No. 26 wire and a weak acid solution.

Drill two holes in the rubber cork the size of the screws that fit on the binding posts. Drill a small hole through the center of the cork to allow any gases that might form, to escape. To the under side of the binding post screws, solder enough of the copper wire to reach two-thirds of the way down the test-tube, when the cork is in tight. Fill the tube three-quarters full of a weak sulphuric acid solution, or water to which has been added a little vinegar.




Test tube polarity indicator.

To test the polarity of a circuit, place to the terminals of the indicator the two wires from the circuit under test. Bubbles will form around the wire immersed in the solution to which the negative wire is attached.

*Contributed by L. Kelley.*

## HOME-MADE AERIAL INSULATOR

An efficient aerial insulator may be made at a very small cost, if constructed as shown in the accompanying diagram. In

(*Continued on page* 1454)

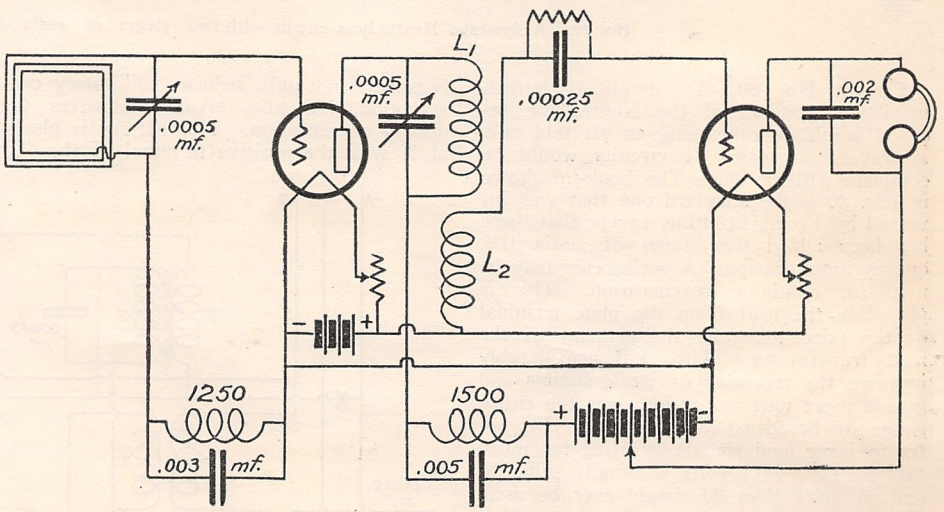
# STANDARD HOOK-UPS

EVERY month we present here standard hook-ups which the Editors have tried out and which are known to give excellent results. This leaf has perforation marks on the left-hand margin and can be cut from the magazine and kept for further reference. These sheets can also be procured from us at the cost of 5c to pay for mailing charges.

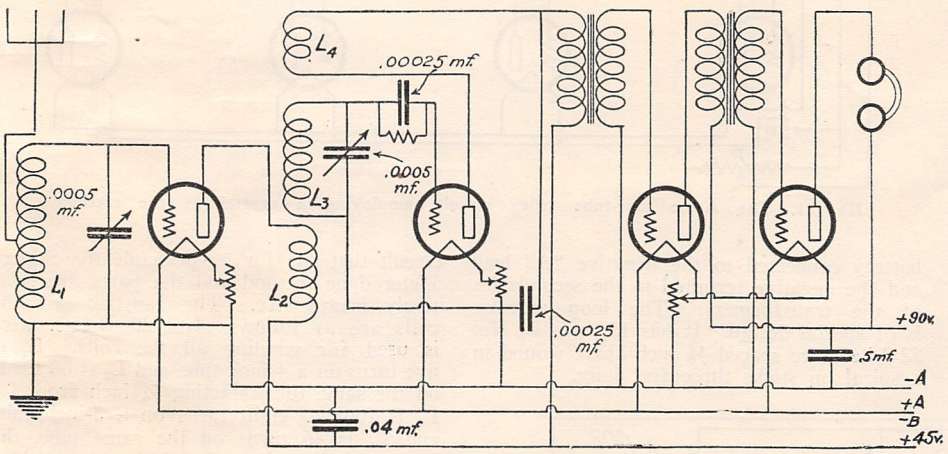
RADIO NEWS has also prepared a handsome heavy cardboard binder into which these sheets may be fastened. This binder will be sent to any address, prepaid on receipt of 20c. In time there will be enough sheets to make a good-sized volume containing all important hook-ups. Every year an alphabetical index will be published enumerating and classifying the various hook-ups.

## Handy Reference Data for the Experimenter

**Circuit No. 77.** Although the Super-Regenerative type of set is a more or less difficult one to master, when the experimenter does get it adjusted properly the results obtained are gratifying. In Fig. 77 is shown a two tube "Super" that presents no great difficulties of construction. The inductance $L_1$ consists of 16 turns and $L_2$ of 40 turns of No. 26 D.C.C. wire, both coils being wound on the same 3½-inch tube. with ½ inch between windings. The inductances of 1,250 and 1,500 turns should be of the honeycomb coil type and should be in inductive relationship with each other. The loop should be about three feet square and have 10 turns, which are spaced ¼ inch apart. To operate at maximum efficiency, UV-201A type of tube should be used and at least 90 volts on the plate of the first tube, the oscillator and 45 volts on the plate of the second, which is the detector, although this latter figure may be varied, depending on the individual tube. The variable condensers should have vernier attachments or else micrometer dials, as the tuning of this circuit is very sharp.



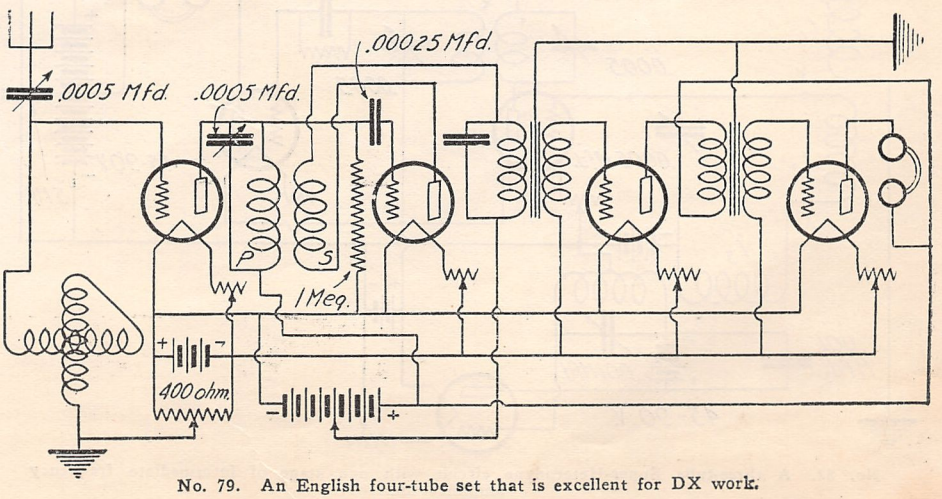

No. 77. Two-tube Super-Regenerative circuit with two condensers for tuning.



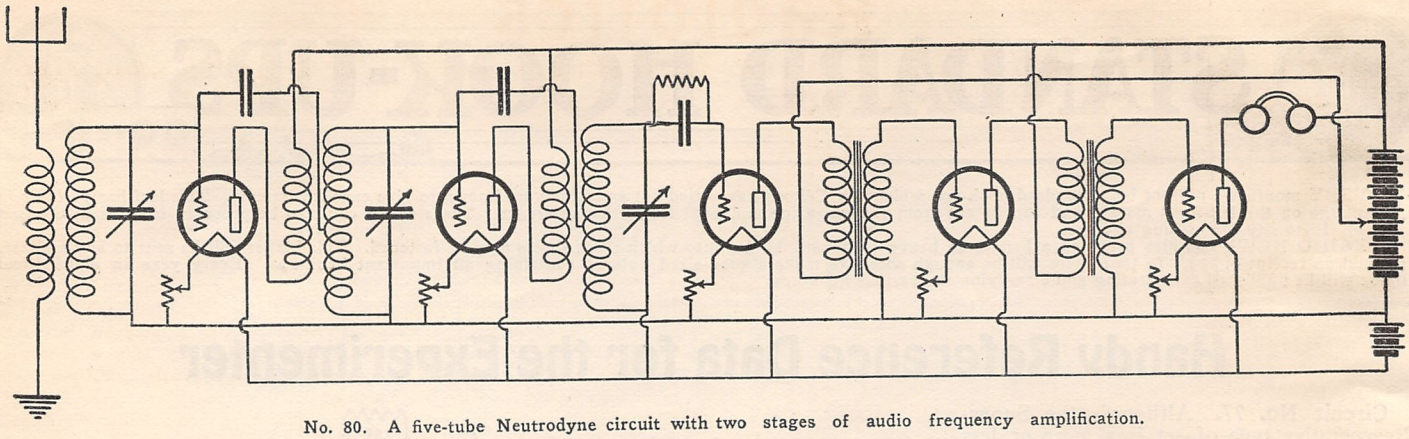

No. 78. The four-tube Teledyne circuit, which has a wide wave-length range.

**Circuit No. 78.** The Teledyne circuit is one which has stood the test of time and is famous for its extreme selectivity and the fact that it will not radiate. This set has a wave-length range of 200 to 550 meters and has the same dial settings at all times for a given station. The variocoupler is a 3-inch length of 3-inch tubing for the stator and a ¾-inch length of 2¼-inch tubing for the tickler coil. The tickler $L_4$, has 28 turns of No. 26 S.S.C. wire and the stator $L_3$, has 39 turns of No. 24 S.S.C. wire. The inductance $L_2$ consists of four turns of No. 24 S.S.C. wire, wound directly over $L_3$, but separated by a strip of varnished cambric cloth. A standard variocoupler may be used instead of $L_3$ and $L_4$. For $L_1$ wind 68 turns of No. 26 S.S.C. wire, tapped at the fifteenth turn, on a 3-inch tube. A 7x24-inch panel is required for this set and UV-201A or UV-199 tube are recommended for best results. Jacks may be used in the audio frequency amplifier stages.

**Circuit No. 79.** For the fan who wishes a set that is stable and excellent for DX work, we can recommend the one shown in Fig. 79. It is an English circuit and built entirely of standard parts. The variometer in the antenna circuit and the variocoupler that is used as a radio frequency transformer should be of a high grade, for the proper functioning of the circuit is dependent upon their quality. The 400-ohm potentiometer is used to place the correct grid bias on the radio frequency tube. The cores of the audio frequency transformers are shown connected to ground, but this is optional. Connect the stationary plates of the variable condenser in the antenna circuit to the antenna binding post and those of the variable condenser across the stator of the variocoupler to the plate binding post of the tube. UV-199 tubes will work very well in this set, but it is recommended that UV-201A tubes be used for the best results. The audio frequency transformers should have a ratio of 5 or 5½ to 1. At least 90 volts "B" battery should be connected to the plates of all the tubes, with the exception of the detector.



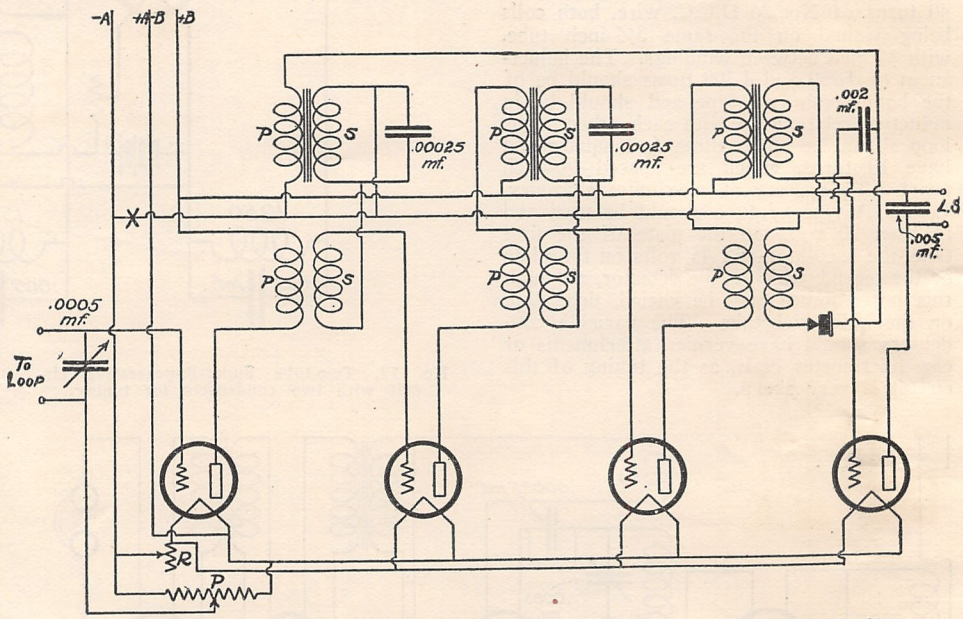

No. 79. An English four-tube set that is excellent for DX work.



No. 80. A five-tube Neutrodyne circuit with two stages of audio frequency amplification.

**Circuit No. 80.** To dwell at length upon the wonders of the Neutrodyne receiver would be rehearsing an oft told tale. However, no series of circuits would be complete without one. The hook-up shown in Fig. 80 is the standard one that was invented by Prof. Hazeltine, except that there has been added two stages of audio frequency amplification. A variometer may be used for obtaining regeneration. This is placed in the lead from the plate terminal of the third tube and the primary of the next transformer. This will considerably improve the reception of weak signals and give a more uniform action over the entire range of broadcast wave-lengths. Do not try to force loud signals by using too much "B" battery; 67½ volts is usually sufficient and no more than 90 should ever be used. The condensers shunted across the secondaries of the "neutroformers" have 17 plates and by careful adjustments, when placing the dials on them, stations can be tuned in at approximately the same readings for all three. UV-201A type of tubes will be best in the four amplifier stages and the UV-200 type should be used as a detector.

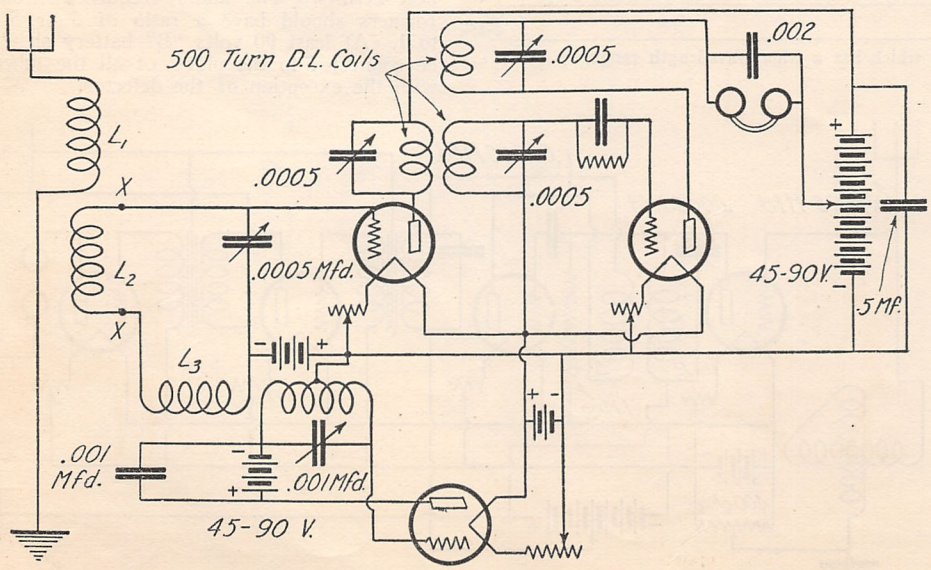
**Circuit No. 81.** In the accompanying diagram is the Acme reflex circuit, which has three stages of radio frequency amplification, a crystal detector, and three stages of audio frequency amplification. There are but four tubes used, however, which should be of the UV-201A type. The crystal should be a fixed detector. If the set has a tendency to oscillate or howl, try reversing the leads of the transformers one pair at a time until the noise has stopped. The use of a "C" battery is good practice in this, as in any circuit that has more than three tubes, because it not only reduces "B" batery consumption, but also greatly improves the quality of reception. This battery is placed at X with the positive terminal of the "C" battery connected to the negative "A" lead and the negative terminal to the secondaries of the transformers. The loop antenna is of special design. It has 15 turns of No. 22 Litz. wire spaced ⅜ inch apart wound in a spiral on sticks three feet long.




No. 81. The Acme four-tube reflex circuit, employing a crystal as the rectifier.

**Circuit No. 82.** Many fans are anxious to experiment with the Super-Heterodyne circuit, but the expense of the equipment has prevented them. In Fig. 82 is shown a circuit that has for its principle the Super-Heterodyne method and the parts are relatively inexpensive. The constants of the coils are as follows: No. 20 D.C.C. wire is used for winding all the coils. $L_1$ is five turns on a 4-inch tube and $L_2$ is 68 turns on the same tube, starting ¼ inch from $L_1$. $L_3$ is four to eight turns on a 3-inch tube and $L_4$ is 46 turns on the same tube, the latter winding being tapped at the 23rd turn. The three honeycomb coils in the plate circuit of the two tubes should be placed in a regulation mounting, so that their inductive relationship may be varied. If a loop is used with this circuit it is connected in the places marked X, thereby eliminating the primary and secondary windings, $L_1$ and $L_2$. The set is tuned by the .0005 mfd. condenser across the secondary and the .001 mfd. condenser in the oscillator circuit. The three .0005 mfd. condensers shunted across the honeycomb coils need very little adjusting after once being set.

The tuning of this circuit is not very difficult. Place the .0005 mfd. variable condenser in the L L circuit at a low scale reading and slowly turn the .001 mfd. variable condenser, which controls the oscillator circuit, until a hissing noise is heard. If no signals come in at this point increase the .0005 mfd. condenser reading one or two degrees and retune the oscillator circuit condenser until the hissing is again heard. This is continued until signals are heard.




No. 82. A three-tube Super-Heterodyne circuit with one stage of intermediate frequency amplification.

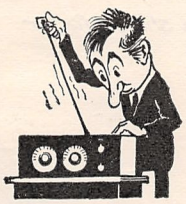
# Radiotics

## BURGLAR PROOF GRID

Among a batch of radio tips appearing in the *Worcester Telegram* of March 23, 1924, we find reference made to "a strong size GRID LOCK." Now what is a grid lock for? Does it insure a burglar proof circuit, or does it prevent the grid from leaving the tube at night when there is a wild party on? At any rate, it is a good idea if one can obtain a non-pickable lock.

*Contributed by Francis Mailey.*

## FLEXIBLE DIELECTRIC



Something new in the art of radio. The *Chicago Salvage Stock Stores,* in a recent edition of their catalog advertise tested fixed condensers in which "only the highest grade of individual tested pure INDIA RUBBER MICA is used." I have been informed by the janitor's son that pure India Rubber Mica is mined in the wilds of South Africa and is sold by the flexible square inch. But what I want to know is how they make a fixed condenser out of this flexible dielectric.

*Contributed by Ford Michael.*

## HANDS UP!

The *Calgary Daily Herald* of Tuesday, Nov. 1, 1924, contains the advertisment of a unique radio set, said ad reading: "Beautiful Radio Set with head phones and a NEW FIXED PISTOL." By tuning in the desired station and pointing the muzzle of the pistol in the correct direction, no doubt the bum artist despatching his wares at the defenseless public may be gently eased of his life and annoyance. There is no other use for the contraption that I can think of at the moment.

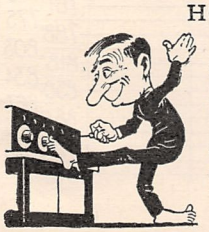
*Contributed by W. E. Dawson.*

## MARVELOUS

Hark to this ad which appeared in *Radio World* of October 18, 1924. "TUBLESS set works loud speaker, by the Rev. Henry A. Judge, S. J., IN TWO PARTS . . " Evidently the Rev. was run over by a wild radio wave. This should be a lesson to those who try for DX without using tubes on their set.

*Contributed by Dr. Harry L. Addison.*

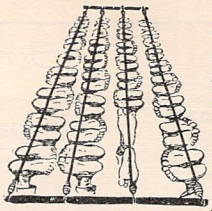
## HOW?



In the *Sutcliffe Company's* radio catalog we learn of a most marvelous feat of magic. In their advertisement of Crosley filament switches they say "when added to a set, the operator may cut off current and *come back to same station without returning.*" That's like eating your cake and still having it. Hooray for the Crosley filament switch!

*Contributed by J. Spencer Ripley.*

## A FEAT WITH FEET



In the *Radio Digest* of November 1, appears a description of a novel antenna mast employed by Gimbel Brothers in their new station in New York City. It reads "the antenna consists of a four wire flat top supported BY 137 FEET above the roof . . . " In the past steps have been taken to erect novel antenna masts, but who ever thought of using feet? Imagine this huge tower of toes reaching up into the sky.

*Contributed by Clarence Le Roy.*

## A NEW MODE OF TRAVEL

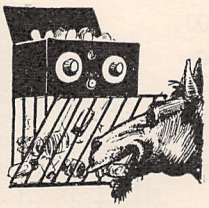
The *Sunday Call* (Newark) of July 20, 1924, in their Current Comment on Broadcasting Department stated that "Three gangs of hold-up men recently were caught *on a wavelength of 286 meters . . .*" Fools step in where angels fear to tread. These men were evidently stealing a ride on a radio wave. Possibly they were going to hold up some rich man by entering his house through his radio set.

*Contributed by C. Mogensen.*

**If you happen to see any humorous misprints in the press, we will be glad to have you clip them out and send to us. No RADIOTIC will be accepted unless the printed original giving the name of the newspaper or magazine is submitted. We will pay $2.00 for each RADIOTIC accepted and printed here. A few humorous lines from each correspondent should accompany each RADIOTIC. The most humorous ones will be printed. Address all RADIOTICS to**

**Editor RADIOTIC DEPARTMENT,**
**c/o Radio News**

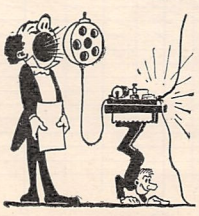
## A CIRCUIT FOR THE HUNGRY



"New 'N' Tube Gives Forth Surprising Results in Armstrong FEED BOX CIRCUIT" is the glaring headline in the November 22, 1923, issue of the radio section of the *Chicago Evening Post.* This is just the thing for the rabid radio hound. He won't have to leave his set for meals. Food in this dietetical circuit is served on the plate of the vacuum tube and the meal is topped off by an after dinner filament.

*Contributed by Roland D. Mann.*

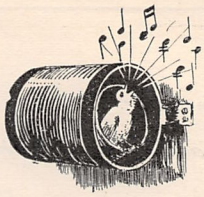
## SOMETHING NEW IN BROADCAST STATIONS



Hark to this clipping from the October 30 issue of the *Indianapolis News,* wherein it is stated that "KDKA's program broadcast several times in the summer months on a *crystal detector set* at a distance of more than 1,000 miles is a considerable achievement in the radio field." Vacuum tubes are evidently no longer necessary for transmitting, according to this report.

*Contributed by Leon E. Stairwalt.*

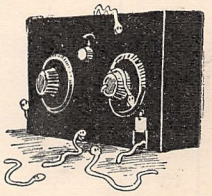
## JUST A LITTLE SONG BIRD



The following enlightening statement is from the *Telegram & Evening Mail Radio Section* of October 25, 1924: "The holes of the shaft should be drilled rather carefully in order that the tickler should not WARBLE." No doubt most of the birdies we hear over the radio are caused by the warbling of tickler coils. (More truth than poetry by the way).

*Contributed by Emil Reisman.*

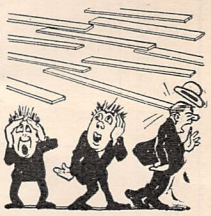
## PROTECT YOUR SPAGHETTI



Westbrook's (Pittsburgh) advertisement in the *Pittsburgh Post* radio broadcasting news of October 29, 1924, reveals a new instrument. They list in their sale a "Malone-Lemon WORM TRAP." No doubt this instrument is supposed to be attached to the Spaghetti on the wiring and trap all hungry worms that trespass.

*Contributed by Chas. L. Chambers.*

## LUMBER BY RADIO



In *Radio Doings* (Los Angeles, Calif.) of October 25, 1924, reference is made to "BOARDCASTING STATIONS." Imagine wood being sped through the air at 186,000 miles per second. We should think that there would always be the chance of a slip up of some kind which might plunge half a lumber yard down on the heads of the people in the streets. Nevertheless it's a good idea.

*Contributed by George Martin.*

## FEMALE RADIOS

In the *Canajoharie Courier* (New York) of October 22, 1924, the Montgomery Electric Light & Power Co. has an advertisement of "RCA LADIOLAS." These are probably female radio sets designed expressly for my lady's boudoir. I wonder if there is a switch handy, so you can turn them off.

*Contributed by George E. Wilcox.*

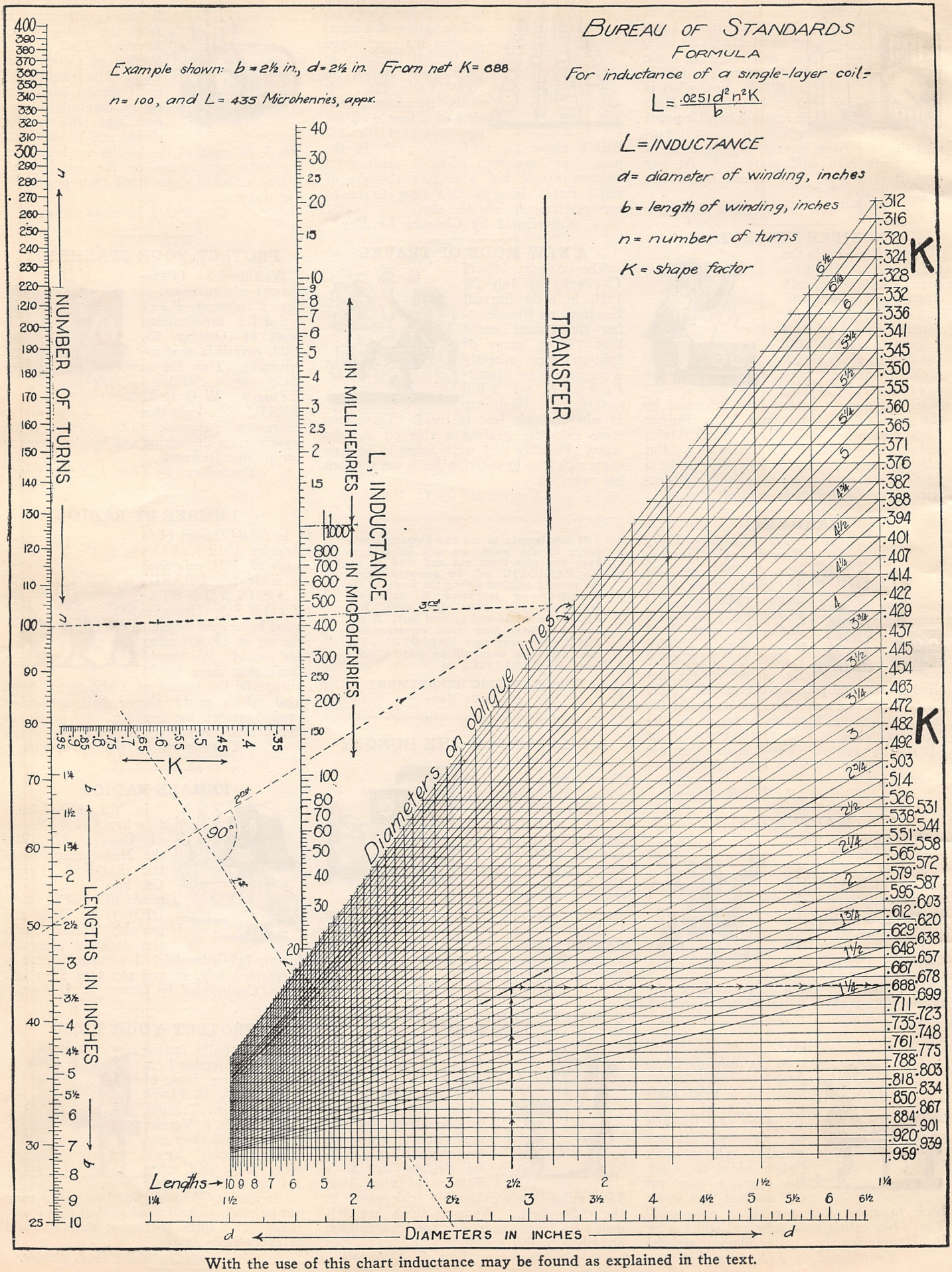
## PROTECT YOUR DOME

A new radio instrument is advertised in the November issue of QST by *M. M. Fleron & Son, Inc.,* Trenton, N. J. It is a Vernier Adjuster and they say, *"Spring holds head away from dial when not in use."* Further on they state, "With slight adjustment spring can be made *to hold head against dial if desired.* This little instrument should appeal to every radio bug.

*Contributed by F. J. Pshide.*

# Charts for Determination of Inductance and Wave-Length

By LAURENCE F. SOUTHWICK




With the use of this chart inductance may be found as explained in the text.

THE charts which accompany this article are graphical methods for solving the two formulæ most frequently met with in the design of radio circuits, those for inductance and wave-length.

These charts (known technically as "nomograms") eliminate the necessity for any mathematical computation so long as all of the variables lie within the range included on the scales. To an experienced slide-rule operator, or to one skilled in the manipulation of logarithms, the formulae present no difficulties but working them out by arithmetic would be a laborious operation. Even the slide-rule is apt to give trouble regarding the location of the decimal point. These charts have been prepared, therefore, for the amateur who wishes to design his circuit to correct values with a minimum of time and trouble. It is particularly in the case of repeated calculations that graphical solutions are of inestimable value as time savers.

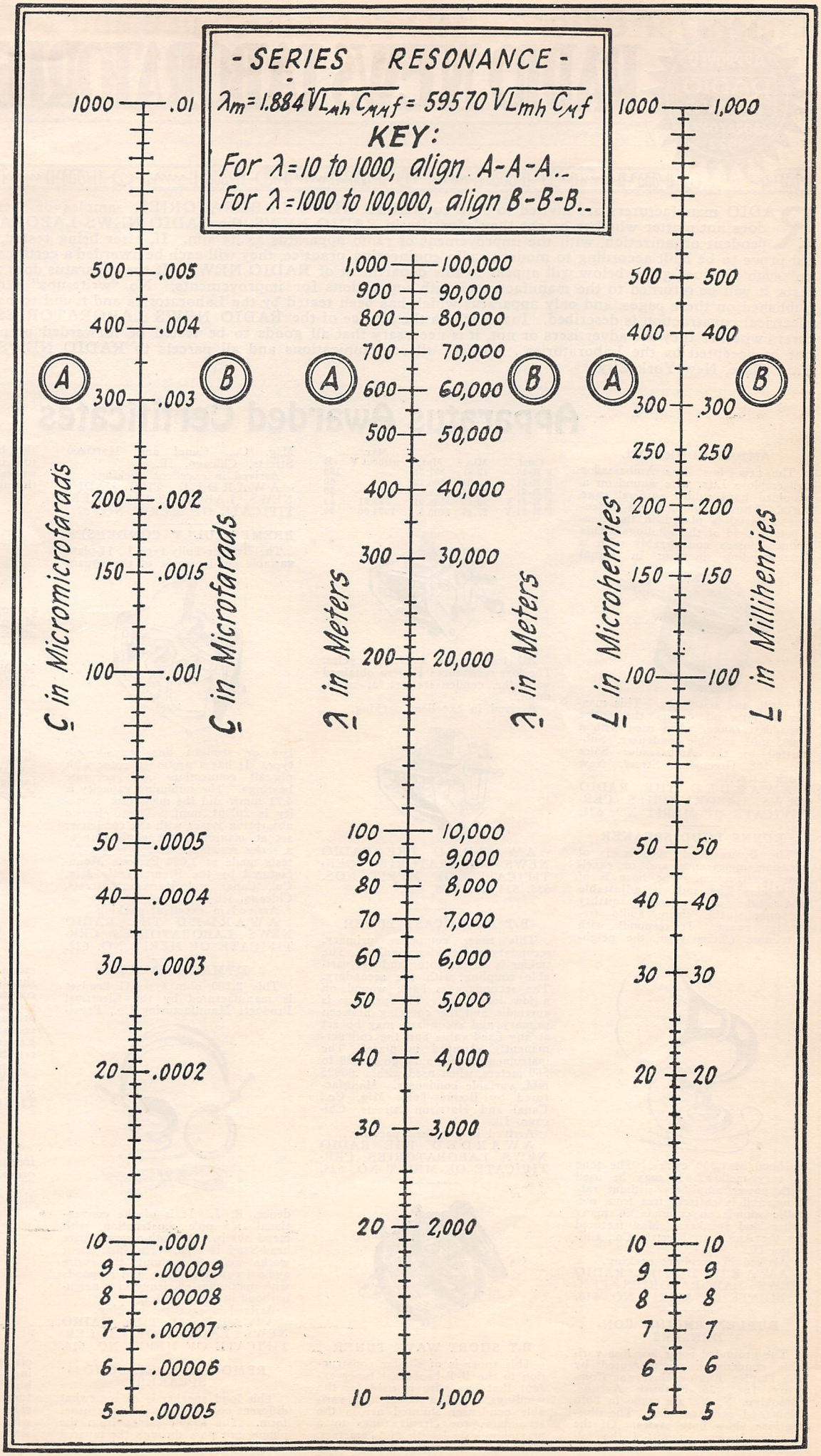
### DIRECTIONS FOR USING THE CHARTS

1. *Wave-length chart.* Simply lay a straight edge, such as the edge of a piece of paper or a stretched thread, across the three scales so that it intersects with the two outer scales at known values of capacity and inductance. It will then cut the wave-length scale at the correct answer. Care must be taken to use only scales A-A-A or B-B-B together. The two sets of scales solve the two equations given on the chart, which allow for different choices of units, and their use gives a great range of values.

*Example*: Suppose a circuit to have an inductance of 400 microhenries and a capacity of 40 micromicrofarads; it will oscillate at approximately 238 meters.

Assume a coil having 450 microhenries inductance and we want to use it in a closed tuned circuit

(*Continued on page* 1460)



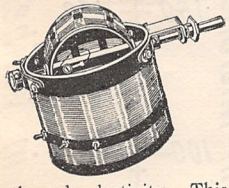

**The author desires to express his sincere indebtedness to Professor Herbert L. Seward, M.E., of the Sheffield Scientific School, Yale University, whose instruction and textbook* (SEE BIBLIOGRAPHY) *have made possible the production of these charts.*

RADIO manufacturers are invited to send to RADIO NEWS LABORATORIES, samples of their products for test. It does not matter whether or not they advertise in RADIO NEWS, the RADIO NEWS LABORATORIES being an independent organization, with the improvement of radio apparatus as its aim. If, after being tested, the instruments submitted prove to be built according to modern radio engineering practice, they will each be awarded a certificate of merit, and a "write-up" such as those given below will appear in this department of RADIO NEWS. If the apparatus does not pass the Laboratories tests, it will be returned to the manufacturers with suggestions for improvements. No "write-ups" sent by manufacturers are published on these pages, and only apparatus which has been tested by the Laboratories and found to be of good mechanical and electrical construction is described. Inasmuch as the service of the RADIO NEWS LABORATORIES is free to all manufacturers whether they are advertisers or not, it is necessary that all goods to be tested be forwarded prepaid, otherwise they cannot be accepted by the Laboratories. Address all communications and all parcels to RADIO NEWS LABORATORIES, 53 Park Place, New York City.

# Apparatus Awarded Certificates

### AMBASSADOR COIL

The new low loss Ambassador coil employs Litz. wire wound on a moulded hard rubber squirrel cage form. Thus a minimum of dielectric material is placed in the electrostatic field of the windings. This reduces losses considerably with a corresponding increase in signal



strength and selectivity. This master tuning coil covers the entire broadcast range, when used with a .0005 mfd. variable condenser. Submitted by the Ambassador Sales Co., 108 Greenwich Street, New York City.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 621.

### BURNS LOUD SPEAKER

The Burns loud speaker is of pleasing appearance and of excellent construction. The horn is of celluloid. The unit is adjustable and works with excellent quality throughout the entire audio frequency range. It responds with maximum efficiency in the neigh-

borhood of 1,300 cycles. The tone is very mellow. It may be used with power amplifiers without rattling, and is entirely free from metallic sounds so common in many other loud speakers. Manufactured by the American Electric Co., Chicago, Ill.

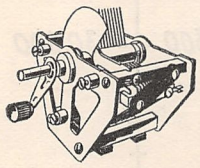
Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 616.

### DUPLEX ENGINE CONDENSERS

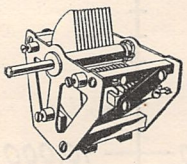
The grounded rotor low loss variable condensers, manufactured by the Duplex Engine Governor Company, Inc., 36 Flatbush Avenue, Brooklyn, N. Y., are made in both plain and vernier styles. The illustrations show both styles. Of the five condensers submitted the following results were obtained:

| Cond. | Min. | Max. | Max. without V | R |
|---|---|---|---|---|
| F R-15 | 12.81 | 357.28 | | 100 |
| F R-21 | 17.08 | 505.12 | | 60 |
| F R-41 | 26.23 | 1018.8 | | 50 |
| F R-21 V | 20.13 | 536.01 | 523.81 | 50 |
| F R-41 V | 27.45 | 1065.6 | 1054.00 | 20 |



All tests made at 1,000 cycles. The loss resistances R were obtained with the condensers set at maximum.

Arrived in excellent packing.



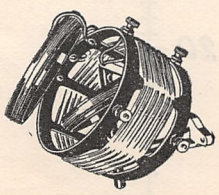
AWARDED THE RADIO NEWS LABORATORIES CERTIFICATES OF MERIT NOS. 633, 634, 635, 636, 637.

### B-T BROADCAST TUNER

This tuner comprises primary, secondary and tickler windings. The tickler is on the rotor and has variable coupling with the secondary. The secondary is bank wound on a low loss form. The primary is aperiodic and the coupling between primary and secondary may be set at any fixed value and the coil permanently clamped in place. The instrument covers a range of 220 to 560 meters, when used with a .00025 mfd. variable condenser. Manufactured by Bremer-Tully Mfg. Co., Canal and Harrison Streets, Chicago, Ill.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 628.



### B-T SHORT WAVE TUNER

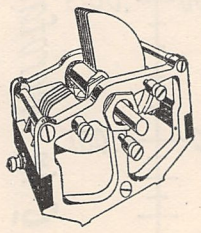
This tuner is of similar construction to the B-T broadcast tuner except that less wire is used for the windings. With a .00025 mfd. variable condenser shunted across the secondary, the circuit tunes to a maximum wave-length of 140 meters. Manufactured by the Bremer-Tully Mfg. Co., Canal and Harrison Streets, Chicago, Ill.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 629.

### BREMER-TULLY CONDENSER

The Bremer-Tully type L, 11-plate variable condenser is of the square



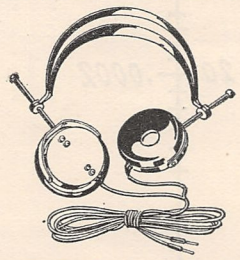
law or straight line wave-length type. It has a grounded rotor with pig-tail connections and accurate bearings. The minimum capacity is 6.71 mmf. and the maximum capacity is 207.01 mmf. The dielectric absorption losses with the condenser set at maximum are equivalent to a series resistance of 250 ohms. All tests made at 1,000 cycles. Manufactured by the Bremer-Tully Mfg. Co., Canal and Harrison Streets, Chicago, Ill.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 627.

### DYMAC HEADSET

This 2,200 ohm type G headset is manufactured by the Electrical Products Manufacturing Co., Provi-



dence, R. I. It is of the conventional two pole construction, with metal shells. A cloth-covered wire head-band is used. The instrument works well throughout the entire audio frequency range and responds with maximum efficiency in a neighborhood of 2,400 cycles.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 614.

### REMO TRUMPET LOUD SPEAKER

This loud speaker is of somewhat different construction than the usual form. The sound waves from the phone unit pass through the tapered tone arm and are reflected out by the bell-shaped horn. The phone unit is of standard construction and works with excellent efficiency throughout the entire audio fre-

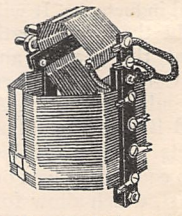
quency range. The horn is of metal. Manufactured by the Remo Corporation, Meriden, Conn.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 618.

### EASTERN LOW LOSS COUPLER

The windings of this low loss three circuit tuner are self-supporting and clamped in two places with insulating strips as the illustration shows. The secondary covers a



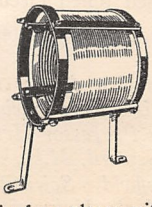
range of 160 to 525 meters when shunted by a .0005 mfd. variable condenser with the antenna and ground disconnected. The five turn primary is wound directly over the secondary. Manufactured by the Eastern Coil Corporation, 22 Warren Street, New York City.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 630.

### AERO-COIL

Low loss coils for tuned radio frequency receivers are necessary in order to obtain selective reception. The aero-coils are composed of a single layer of insulated wire



clamped in four places with insulating strips. No shellac or other binding compound is used. A six-turn primary winding is placed inside of the secondary. When used with a .00035 variable condenser a wave-length range of 190 to 575 meters is covered. Three of these

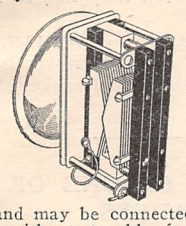
coils are furnished in a kit with brackets for mounting. Manufactured by the Henninger Radio Mfg. Co., 1772 Wilson Avenue, Chicago, Ill.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 625.

### WADE SQUARE LAW CONDENSER

The salient features of the Wade condenser are the low losses, low minimum capacity, straight-line wave-length curve, separately grounded frame, and vernier control dial. Both sets of plates are separately insulated from the frame-



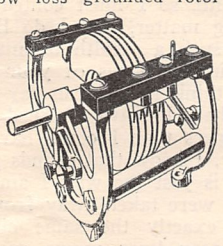
work and may be connected in any circuit without trouble from body capacity, by grounding the frame. The .0005 mfd. type submitted by the Wade Mfg. Co., 1819 Broadway, New York City, has the following characteristics: minimum capacity, 3.66 mmf., maximum capacity 491.28 mmf., dielectric absorption losses with the condenser set at maximum, equivalent to a series resistance of 10 ohms. All tests made at 1,000 cycles.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 632.

### FLEWELLING CONDENSER

The Flewelling Type R condenser is manufactured by the Buell Mfg. Co., 2973 Cottage Grove Avenue, Chicago, Ill. The instrument is of the low loss grounded rotor con-



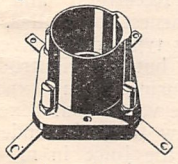
struction and has the low minimum capacity of 5.49 mmf. The maximum capacity is 232.01 mmf. Equivalent series resistance with the instrument set at maximum is 180 ohms. All tests made at 1,000 cycles.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 638.

### FLEWELLING SOCKET

This socket is of bakelite with long contact springs that make connections to the sides of the vacuum tube prongs. The springs extend



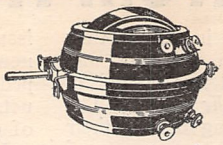
out beyond the socket so that connections can be soldered directly to them. Binding post terminals are also supplied. Manufactured by the Buell Mfg. Co., 2973 Cottage Avenue, Chicago, Ill.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 639.

### VARIABLE CLARIFYING SELECTOR

This instrument is used in place of the ordinary variocoupler and has an aperiodic primary, the coupling of which may be varied. The primary is wound on both rotor and stator, variometer fashion, and has variable coupling to the secondary winding. The secondary winding is on the stator and covers a range of 200 to 600 meters when used with a .0005 mfd. variable condenser. This instrument is ideal for use in tuned radio frequency re-



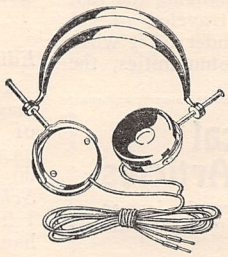
ceivers. Manufactured by Langbien & Kaufman, 654 Grand Avenue, New Haven, Conn.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 626.

### N & K HEADSET

The N & K, Model D, headset is of the standard two pole construction with metal shells and large ear-caps. The head band is leather covered and the phones may be worn comfortably. They are very sensitive throughout the entire audio frequency range and reproduce broadcast music with excellent qual-



ity. The phones are made in Germany and sold in this country by the Goldsmidt Corporation, 15 William Street, New York City.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFCATE OF MERIT NO. 612.

### N & K PHONE UNIT

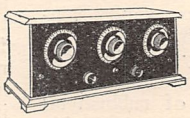
The type W, N & K Phone Unit is of the standard two pole design and may be attached to a phonograph tone arm or other horn. The instrument is very sensitive and is well constructed. It reproduces with little distortion. Submitted by the Goldsmidt Corporation, 15 William Street, New York City .

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 613.

### FRESHMAN MASTERPIECE RECEIVER

This five-tube tuned radio frequency receiver is very compact and rugged in construction. The panel is 7 x 18 inches, placed on a highly finished cabinet. The set comprises two stages of tuned radio frequency amplification, detector and two stages of audio frequency amplification. It covers the entire broadcast wave-length range and is very sensitive and selective. The quality is also good. Stagger wound coils and low loss condensers are used. Manufactured by the Chas. Freshman Company, Inc., 106 Seventh Avenue, New York City.



Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 623.

### DULCE TONE PHONE UNIT

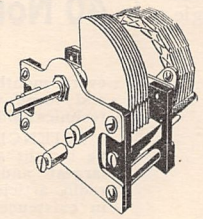
In order to attach the ordinary phone unit to a phonograph it is usually necessary to remove the phonograph reproducer. This is unnecessary with the Dulce Tone Radio Talking Machine Speaker. The vibrating armature of this instrument is slotted, and the needle of the phonograph rests in this slot. Thus the vibrations are communicated to the diaphragm. The Model V instrument submitted is especially designed for Victrolas. It is exceptionally sensitive and reproduces with excellent quality. Manufactured by the Teagle Co., 115 Oregon Street, Cleveland, Ohio.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 615.

### FRESHMAN MASTERPIECE KIT

Three tuned radio frequency transformers with full directions for building the Freshman Masterpiece receiver are furnished in this kit. The transformers comprise a stagger wound primary and secondary mounted on a low loss variable condenser. They cover a wave-length range of 200 to 575 meters. Manufactured by the Chas. Freshman Co., Inc., 106 Seventh Avenue, New York City.

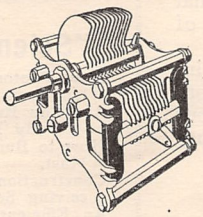


Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 624.

### AMSCO CONDENSER

The 23-plate Amsco low loss condenser has a maximum capacity of 569.56 mmf., and a minimum capac-



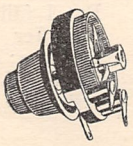
ity of 9.15 mmf. The dielectric absorption losses with the condenser set at maximum are equivalent to a series resistance of 53 ohms. The condenser is of the grounded rotor type with pig tail connection. Manufactured by the Amsco Product, Inc., Broome and Lafayette Streets, New York City.

Arrived in good packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 640.

### AMSCO DUBLWUNDER

This instrument comprises both rheostat and potentiometer. The small knob controls the potentiometer adjustment and the large knob the rheostat adjustment. The instrument submitted has a six ohm rheostat and 400 ohm potentiometer. Other sizes are also manufactured by the Amsco Products, Inc., Broome and Lafayette Streets, New York City.



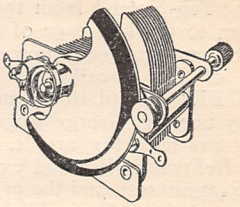
Arrived in good packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 641.

### RED SEAL CONDENSER

The Red Seal 23-plate variable condenser is manufactured by the Manhattan Electric Supply Co., Inc., New York City. This condenser is of the grounded rotor low loss construction. The plates are counterbalanced by a metal weight which also serves for the vernier. The condenser has a minimum capacity of 20.13 mmf. and a maximum capacity of 501.4 mmf. The dielectric absorption losses with the instrument set at maximum are equivalent to a series resistance of 33 ohms. All tests made at 1,000 cycles.

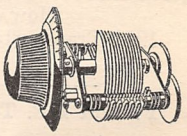
Arrived in excellent packing.



AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 620.

### U. S. TOOL CONDENSERS

These condensers employ one-piece brass plates, stamped from sheet brass and folded back and forth. The style 6 grounded rotor condenser has a minimum capacity of 12.5 mmf. and a maximum capacity of 500.4 mmf. The style 3 insulated end plate condenser has a minimum capacity of 10 mmf. and



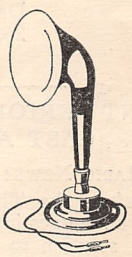
a maximum capacity of 526 mmf. The dielectric absorption losses are equivalent to a series resistance of 30 ohms. All tests made at 1,000 cycles. Manufactured by the U. S. Tool Company, Newark, N. J.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 631.

### MANHATTAN JR. LOUD SPEAKER

This loud speaker is of very simple and rugged construction. The phone unit is adjustable and reproduces with excellent quality and volume throughout the entire audio range. The tone is somewhat lower than that of the average loud



speaker and it responds with maximum efficiency in the neighborhood of 600 cycles. A fibre horn is used. Manufactured by the Manhattan Electric Supply Co., Inc., New York City.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 619.

### MICADENSER

This type of fixed condenser employs brass plates with mica insulation and the entire unit is well protected and shielded by a heavy metal case. The condensers are very accurate as to their capacity ratings. The losses are equal to the average

losses in other mica insulated condensers. Manufactured by the Ben Franklyn Radio Mfg. Co., 2652 Superior Avenue, Cleveland, Ohio.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 622.

# Correspondence from Readers

## CONGRATULATORY COMMENTS

*Editor,* RADIO NEWS:

I cannot refrain from commenting on the general excellence of the December number of RADIO NEWS. It seems to be more than ever "Top-Notch" from the excellent cover design to the last page of advertising.

The exposure of a new radio "swindle"; that of the so-called "NEUROPHONOMETER" offered to the unsuspecting public by one Dr. George Rogers, is a particularly praiseworthy article. The sketch of Dr. DeForest's life and experiences is also of great interest, and the promise of a series of articles on Reginald Fessenden marks another great scoop for RADIO NEWS.

I hear only praise for RADIO NEWS from amateur, broadcast listener, commercial operator and engineer, and I'm sure hundreds of thousands of readers will agree with me in stating that in RADIO NEWS can be found the greatest collection of information, both technical and non-technical to be found between the covers of any single radio magazine today.

Congratulations!

HOWARD S. PYLE,
1922 Transportation Building,
Chicago, Ill.

## FROM DR. TALMEY

*Editor,* RADIO NEWS:

My attention has been called to an article in the December issue of RADIO NEWS wherein the writer asserts that I have given up Dr. Zamenhof's international language project because I could not sell my book on it; further that my personal friend Prof. Einstein has endorsed the ajn-, ojn-, ujn-jargon. Please permit me to state that both these assertions belong in the realm of fable.

Other myths in the article about the international language situation do not concern my personal friends or myself. Your readers can find out the real facts if they care to.

DR. MAX TALMEY,
266 West 113th St.,
New York City.

## SILENT PERIODS AND BROADCAST ARTISTS

*Editor,* RADIO NEWS:

Just before the Third Radio Conference I wrote you suggesting the necessity of finding some solution to the question of interstation interference; you wrote a very excellent editorial on it. It seems to me that two very vexing questions concerning broadcasting could be partly solved without much difficulty—I refer to this same station interference and the question of pay for "artists."

If stations could be induced to imitate WGY and be content to observe occasional silent periods, it would lessen interference, cut down their operating expense—and be a blessed relief to many. The Westinghouse stations were good enough to adopt this policy some time ago. A silent night now and then, or even a silent period of an hour would help a lot.

Pay for broadcasting "artists" should not be given serious consideration; with negligible exceptions they should be required to pay a fee for the privilege of assailing the ears of a long-suffering public. It is puerile to even think of paying the usual run of "artists" secured by such stations as WTAS, WAHG, WSAR, WSAD, WKBF, WDBH and about four hundred and fifty others. WTAS is an excellent case in point: they begin broadcasting early in the day and keep it up without stop until *two o'clock in the morning every day of the week!* The class of performers appearing before their microphone could not possibly get on one of the lesser vaudeville circuits, and permitting them to broadcast is simply pandering to the well-known vanity of the so-called "artist." In addition to using the air to make an additional and unnecessary noise, these stations are never by any chance on their allotted wave-length, so that in their wanderings in the ether they make beat notes with stations in their immediate wave-length vicinity—which means a total loss of that part of the dial.

The chap who likes to hunt one of the far western stations and, if he finds it, gets a lot of quiet pleasure in visualizing the vast spaces the tiny sound has traveled to get to him, and who sees the wonder of it when he thinks of the thriving communities, the broad prairies, the giant mountains and the silent wastes of desert which intervene between him and the busy restaurant where the voice started—this chap has to wait until along towards sunrise because some local station is using the air to promulgate the latest syncopated atrocity rendered by a young man who sings through his nose and makes other queer noises which his microcephalic brain and his limitless vanity conceive as entertainment! Ugh!

I am told tastes differ—they certainly do! But I fail to see why we should be obliged to suffer interminable hours of rubbish *all* the time; let them have a fling a reasonable length of time—and then let some of the rest of us have peace.

WILFRED TAYLOR,
Thompson, Conn.


**40 Non-Technical Radio Articles**

every month for the beginner, the layman and those who like radio from the non-technical side.

SCIENCE & INVENTION, which can be bought at any newsstand, contains the largest and most interesting section of radio articles of any non-radio magazine in existence.

Plenty of "How To Make It" radio articles and plenty of simplified hook-ups for the layman and experimenter. The radio section of SCIENCE & INVENTION is so good that many RADIO NEWS readers buy it solely for this feature.

**List of Radio Articles Appearing in the February Issue of "Science and Invention"**

How Photos Are Transmitted Across Atlantic via Radio.
Are You Buying Good Tubes? By Leon L. Adelman, A.M.,I.R.E.
How to Build a 100-Foot Wooden Latticed Mast. By Fred A. Parsons, 2ABN.
Construction of a Low Loss Broadcast Receiving Set. By Frank Frimerman.
An Efficient Two-Tube Reflex Circuit. By Alfred R. Marcy, A.M.,I.R.E.
A 25-K.W. English Broadcast Station.
Latest Radio Developments Illustrated in Pictures.
Radio Oracle—Questions and Answers—Illustrated.
Radio Wrinkles.
Latest Revised List of Broadcast Stations Complete.


## REFLEX OWNERS TAKE NOTE

*Editor,* RADIO NEWS:

I had always placed your publication foremost in the radio field out of all the other periodicals I purchase, but your November issue is not only a masterpiece as far as news articles go, but a veritable encyclopedia of reliable manufacturers and products. I'd miss RADIO NEWS if it went out of existence, I assure you.

I wonder if it would not be possible to get in touch, through your columns, with radio amateurs who have built their own reflex sets, especially the Erla type. I am anxious to compare DX and operation notes with them. If you can help me, it will be appreciated.

FRANK J. HOFFMAN,
462 Hanover St.,
Milwaukee, Wis.

## THE OPINION OF ONE OF OUR READERS

*Editor,* RADIO NEWS:

I have been a devoted reader of your magazine ever since I saw the first issue of the old *Radio Amateur News* on the local newsstand. I don't know what I would do without it and its sister magazines, *Science & Invention* and *The Experimenter.* I have my first copy of the last named at hand and it sure seems good to see the old *Electrical Experimenter* staging a "comeback." I read my first copy of the *Electrical Experimenter* too long ago to remember, and it has been my favorite ever since.

You can better realize what these magazines mean to me when I say that I seldom, if ever, get a chance or have the material to experiment with, so I must content myself with reading matter, and I do like to read, especially such a wealth of material as is contained in the pages of your three publications. I think that I can say without prejudice that I have learned more through your papers than I could have any other way. Now, I know that sounds pretty strong, but that is just the way I am feeling; if the three were taken away from me. I would be in exactly the same circumstances as an ocean liner minus compass, rudder and captain.

RICHARD J. STEPHENS,
U. S. Naval Hospital,
San Diego, Calif.

## NEUTRODYNE VS. REGENERATION

*Editor,* RADIO NEWS:

I have just read the article, "Neutrodyne vs. Regenerative Receivers" and heartily agree with Mr. Earnest, of Dallas. I have worked with many types of receivers in an experimental way, but my Neutrodyne has been the standby during all my experiments, and when I became very much vexed at the results of some new fangled wonder circuit I would snap on the juice in my "Neut." and in its performance I would forget my troubles. For the good old Neut. spouted forth consoling music, the minute its tubes received the life-giving electricity. No fuss, no bother, no uncanny squeals. As for DX it is not the best, but neither is it the worst. I have listened to both coasts from my location and I don't want any better results, because they are hard to beat. I have listened to the east coast regularly all this summer, despite the bothersome static and a receiver that will bring in 1,000 miles *consistently* and with absolutely pure tone. The Neutrodyne gets the prize. As for volume, I may say that in my location KDKA and KFKX come in so loudly that my horn will hardly

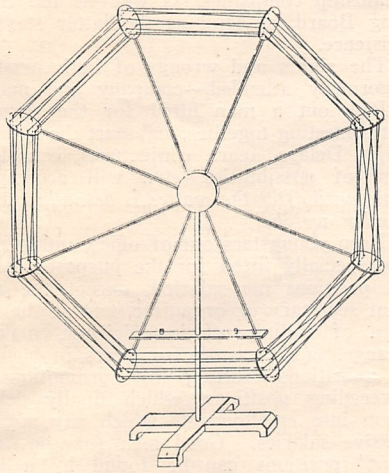
(*Continued on page* 1482)

## By JOHN B. BRADY*

### LOOP AERIAL

(Patent No. 1,510,799, J. H. Rogers. Filed July 12, 1923. Issued Oct. 7, 1924.)

Loop aerial in which all of the turns of the loop lie substantially in the surface of a polygonal torns. The loop is constructed on a frame

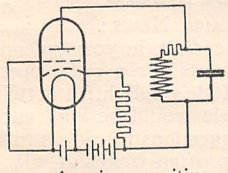


having arms at each end on which a circular disk-like member is provided. The circular members are apertured to receive the turns of the loop, in such position that all of the turns are disposed symmetrically with respect to the others.

### ARRANGEMENT FOR PRODUCING ELECTRICAL OSCILLATION

(Patent No. 1,513,010, H. Rukop. Filed May 3, 1922. Issued Oct. 28, 1924.)

Arrangement for producing electrical oscillations, wherein an electron tube provided with a special positive electrode is employed connected in an oscillatory circuit. The tube contains a

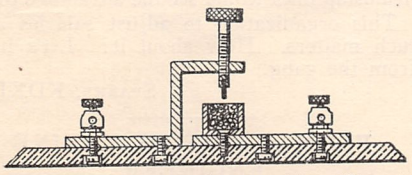


cathode, a space-charging positive electrode, a grid and an anode arranged in the order named. A circuit connects the space-charging electrode and the anode with the cathode. A grid circuit and an anode circuit are provided, the positive space-charging electrode operating to influence the negative characteristic of the tube to maintain the circuits in oscillation.

### RADIO DETECTOR

(Patent No. 1,513,326, W. C. Lamphier. Filed Feb. 9, 1923. Issued Oct. 28, 1924.)

Radio detector, consisting of two contact devices, one of which is a steel-wool sensitive con-

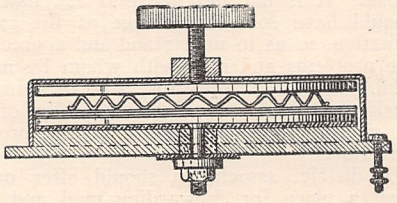


tact member and the other graphite. The steel-wool is mounted in the usual detector cup and the graphite is adjusted in contact therewith to obtain the desired rectifying characteristic.

### VARIABLE LEAKY CONDENSER

(Patent No. 1,506,781. J. E. Shrader. Filed Aug. 18, 1921. Issued Sept. 2, 1924. Assigned to Westinghouse Electric & Mfg. Co., of Pa.)

Variable leaky condenser comprising a plurality of conductors and dielectric material treated with a conducting material interposed between the conductors. The distance between the conductors is made variable by a pressure varying screw, bearing upon one of the conductors, whereby the distance between the conductors is varied at the same time that the resistance may be increased or decreased. The spacing member may be of

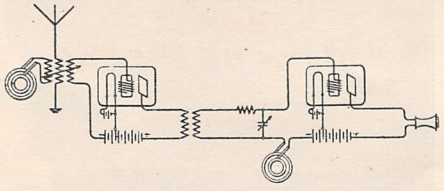


resilient corrugated material adapted to be flattened under variable pressure. The dielectric material may be impregnated with India ink forming a partial conductor. In this way a grid leak and grid condenser may be embodied in the same instrument.

### RADIO SIGNALING SYSTEM

(Patent No. 1,508,151, E. F. W. Alexanderson. Filed April 19, 1916. Issued Sept. 9, 1924. Assigned to General Electric Co. of N. Y.)

Radio signaling system for the reception of signals without disturbances from static effects. The patentee points out that in order to receive signals through strays, a circuit must be provided to discriminate between these two sources of energy by comparing the character of the energy over relatively long periods. A circuit is shown for prolonging the time during which the signal can act with accumulative effect on the receiving cir-



cuit considerably beyond the time during which disturbances can act. In order to prolong the time during which the signals and the disturbances may be compared, a tuned circuit of lower than radio frequency, but above audibility is provided. The desired lower frequency is obtained by means of interference beats between the incoming signals and the local source to produce a current of radio frequency, having amplitude pulsations of much lower frequency but above audibility. This current is used to produce an alternating current having a frequency corresponding to the frequency of the amplitude pulsations. A resonant circuit is provided for accumulating the energy of this alternating current and a detector is operated by the energy thus accumulated.

### STATIC ELIMINATION SYSTEM

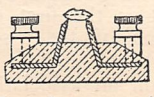
(Patent No. 1,513,286, J. Slepian. Filed Nov. 16, 1921. Issued Oct. 28, 1924.)

Static elimination system for radio receiving apparatus, wherein a resistor having such a value as to effectively damp the receiving system is connected in the antenna circuit. A non-resonant circuit is associated with the resistor in such manner, that the voltage drop therein may be substantially neutralized for currents of predetermined frequency only, whereby the system is screened against static.

### CRYSTAL DETECTOR FOR RADIO RECEPTION

(Patent No. 1,508,893, F. G. Mitchell. Filed June 24, 1922. Issued Sept. 16, 1924.)

Crystal detector for radio reception in which a pair of plates supported by a base is arranged

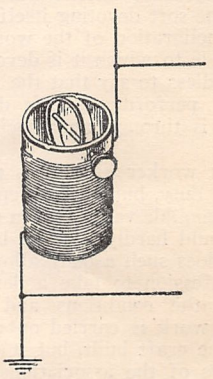


with cerrated edges between which a sensitive crystal is gripped, thereby providing a rectifying system.

### RADIO RECEIVING SYSTEM

(Patent No. 1,510,945, E. B. Lewis. Filed Aug. 8, 1922. Issued Oct. 7, 1924.)

Radio receiving system in which undesired locally generated "feed back" currents occurring in the electron tube circuits, are suppressed and thus prevented from building up to an injurious degree. An absorbing device for the undesired oscillations fed back into the grid circuit from the associated tube circuits is provided. The device comprises an inductance coil in the grid circuit, including an outer stationary ring in series therewith. The stationary outer ring has an inner-closed ring mounted on an axis in the



plane of the outer ring and adapted to be rotated on its axis, whereby the energy of said oscillations will be selectively absorbed by induction and dissipated as heat.

### METHOD OF AND MEANS FOR DETERMINING PHASE DIFFERENCE

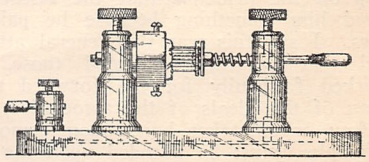
(Patent No. 1,510,792, E. Merritt. Filed July 1, 1921. Issued Oct. 7, 1924.)

Method of and means for determining phase difference whereby the direction of the waves may be determined. The fundamental principle involved is the determination of phase differences between trains of waves or vibrations, by means of the phase difference between the beats that are produced, when these wave trains or vibrations are combined, by the process of heterodyning with another wave train or vibrations of a different frequency.

### CRYSTAL DETECTOR FOR RADIO APPARATUS

(Patent No. 1,508,615, E. C. Rowley. Filed Dec. 27, 1922. Issued Sept. 16, 1924.)

Crystal detector for radio apparatus in which



a multi-point contact element is provided consisting of a conducting disk, a clamping disk and securing means for locking the disks together in order to hold a plurality of cat whiskers between the disks. The plurality of cat whiskers are placed in contact with the surface of a sensitive crystal element.

### RADIO RECEIVING APPARATUS

(Patent No. 1,509,139, D. Grimes. Filed April 21, 1922. Issued Sept. 23, 1924. Assigned to American Telephone & Telegraph Co., N. Y.)

Radio receiving apparatus in which the filaments of the electron tube amplifier are heated from an alternating current of relatively low frequency. A coupling is provided between the filament circuit of the tubes and the source of alternating current including a condenser offering small impedance to radio frequencies and large impedance to other frequencies and a shunt associated with the coupling and arranged to be anti-resonant to radio frequency, but resonant to lower frequency.

(*Continued on page* 1492)

**Patent Attorney, Ouray Building, Washington, D. C.*

# Operators' Associations

By JACK BRONT

THE late Theodore Roosevelt said in an address that "Every man owes something to his profession."

These words strike a startling note to the average member of any profession or craft. In these latter days when almost every craft worker has an organization of some sort devoting itself to the benefits and amelioration of the workers following the trade to which it is devoted, it seems almost needless to say that the most efficient method of performing one's duty to one's profession is through an association of this sort.

That the worker himself is not only discharging a duty, but is also repaying profits of a very tangible variety from such an association should hardly have to be mentioned. Not only does such a body allow every man in the profession to take a definite part in regulating the conditions and laws under which the work is carried on and advancement of the craft built, but it gives, by the very nature of the associations, each member an ideal and a deep respect for his profession and its place in the world.

Roosevelt, on the same occasion said, "If I were a laborer, workman on the railroads or otherwise employed, I would undoubtedly join the union of my profession. If the organization were corrupt I would join in order to force an amelioration and if the officials were crooked, I would join in order to throw them out."

Let us pause and look back at the last operator's organization. Some may not like to make ghosts walk, but it is by our mistakes that we profit, and we should view the inefficiencies that were, in order to circumvent them in the future.

In the old organization there was sloth and inefficiency, indifference and clique, and a general attitude, which screamed the fact that each member was holding his membership on the principle that the Association owed him something because he paid his dues. I say this was the general attitude, and that naturally excluded those, who worked faithfully for the forward movement of the ideals of the association.

Any organization bui.. upon democratic principles, must be founded upon the individual if it is to be successful. If the individual does not lend his whole-hearted cooperation to the program set by the majority of the voters, but looks upon the association simply as a sort of last resort in tough weather, it will be worse than worthless and less than profitless.

There *must* be a perfect harmony and a willingness to co-operation.

People will say such specifications are simply Utopian Ideals dreamed of on a sunny day after a particularly good dinner. But the proof is in hand. Unless there is a structure built firmly upon a foundation of correct principles, co-operation, allegience and shrewd business, the project will topple of its own superweight.

The first consideration in the formation of an operators' association, is that of finances and their collection. It is wise to employ an organizer familiar with such work. It is not too much to ask that he should have some knowledge of the radio situation, so as to understand and appreciate the problems and men with whom he must deal. Some old operator, who is now in business ashore, should be found in order to give the project a start in the proper direction.

A district association should offer more than a place for forwarding mail and obtaining a job. It should be more on the order of a club.

First Officer William Mannheim and Wireless Operator William Horsey of the S. S. "Tena." Horsey picked up the SOS from the S. S. "Zacapa" which recently went aground on an island off Cuba. The "Tena" went to the rescue. (By United.)

Comfort, congeniality, recreation and attractive quarters must be provided or the operator will seek solace elsewhere, although paying dues and living up to rules. When the association quarters are unattractive and the operator first displays a reluctance to call there, it is the first evident signs of the dissolution of the association. (Bear past witness.)

To maintain an association strictly as a labor union affair will mean small or indifferent success and later dissolution.

A firm but flexible contact must be maintained with the radio companies and the steamship companies, as well as the Shipping Board, as long as the latter stays in existence.

The rights and wrongs of both must be vigorously attended,—company and man.

Pick out a man fitted for the purpose, get a meeting together, and start the ball rolling. Delays, fears, conjectures, consideration of possibilities, etc., will accomplish little *until after the matter is actually started "under weigh."*

Keep youngsters out of office, unless they are specially fitted for the purpose. Make all positions non-salaried, except the resident secretary or organizer, and at the first sign of falling off in efficiency, make a change. (Men work for years in business o anizations waiting for promotions to succeeding positions, which finally deliver them into employments which pay not excessive salaries. Good men for the "resident" positions can be found by a little searching.)

Make the association quarters attractive, utilitarian and permanent and then the association will be successful.

The writer would gladly lend a hand in the formation of an association, but other duties at present do not permit. Sincere hopes are indicated, however, *that a sound organization* will soon be under way.

## REGARDING A COMMERCIAL OPERATOR'S UNION

*Editor,* RADIO NEWS:

After reading, in your splendid magazine, many requests for a radio operator's union, and Mr. Pyle's delightful articles, I wonder if Mr. Pyle would be kind enough to offer a few suggestions to aid us to correct those evils he so often writes of, viz: An operator doing extra work; and the formation of some type of organization for which there seems to be a great demand.

Here is an idea: Wouldn't some publication interested in commercial operators start something? They could use the already established magazine as an official organ; charge a small sum as dues and entrance fees to defray the expenses. Soon the radio companies would recognize this association as a benefit to them, and the steamship lines would see the advantage of it.

This organization to adjust salaries and such matters. How about it? Let's hear from the gang.

SPARKS, KDXJ.

## FROM A BRITISH MARINE ENGINEER

*Editor,* RADIO NEWS:

Since my vessel began trading between America and Far Eastern ports over two years ago, I have been a constant reader of your very valuable magazine. I thoroughly appreciate the articles, diagrams and letters of interest. In particular, the letters from 5XZ and answers are indeed interesting.

(*Continued on page* 1446)

THIS Department is conducted for the benefit of our Radio Experimenter. We shall be glad to answer here questions for the benefit of all, but we can publish only such matter as is of sufficient interest to all.

1. This Department cannot answer more than three questions for each correspondent.
2. Only one side of the sheet should be written upon; all matter should be typewritten or else written in ink. No attention paid to penciled matter.
3. Sketches, diagrams, etc., must be on separate sheets. This Department does not answer questions by mail free of charge.
4. Our Editors will be glad to answer any letter, at the rate of 25c for each question. If, however, questions entail considerable research work, intricate calculations, patent research, etc., a special charge will be made. Before we answer such questions, correspondents will be informed as to the price charge.

You will do the Editor a personal favor if you will make your letter as brief as possible.

### FOUR ELEMENT TUBES

(2080) Mr. Earl Owen, Astoria, Ore., asks:

Q. 1. What is the diagram of connections of a set incorporating one stage of tuned radio frequency amplification, detector and one stage of transformer coupled audio frequency amplification, employing the Philips' Tetrode?

A. 1. The circuit for these double grid tubes is shown in these columns.

Note that the plate voltage on the amplifier tubes should never exceed 12 volts. The detector voltage will range between 2 and 4 volts. The amplifier voltage will range between 4 and 10 volts.

The inner grids connect to the positive connections of the respective plate battery taps, as shown. This inner grid connection is the small binding post on the shell of the socket.

These tubes require a special socket since the foreign method of isolating the plate prong is used.

It must be remembered that the terminal filament voltage is only 3½ volts, at ½ ampere.

The standard system of connections for three element tubes is followed throughout, with the exception of the inner control grid shown.

Q. 2. What is the best height for a counterpoise?

A. 2. Ten feet may be considered the average height.

Q. 3. Will the use of a counterpoise in place of my usual ground connection enable me to tune out local stations?

A. 3. If your present ground connection has a high resistance, due to natural or created causes, the resistance should be less with the counterpoise, thus serving to sharpen the tuning of your aerial circuit by decreasing the damping. Whether you will be thereby enabled to tune out your local stations will depend upon the design of the remainder of your set.

### CRYSTAL DETECTORS

(2081) Mr. D. G. Burnside, Detroit, Mich., asks:

Q. 1. It seems very difficult to get the 4 mfd. condensers required for the A.C. adapter described by Mr. Florian J. Fox, in the September, 1924, issue of RADIO NEWS.

A. 1. Two 2-mfd., or four 1-mfd. condensers, connected in parallel will have the same capacity.

Q. 2. What type of resistance should the 5,000 ohm resistance be?

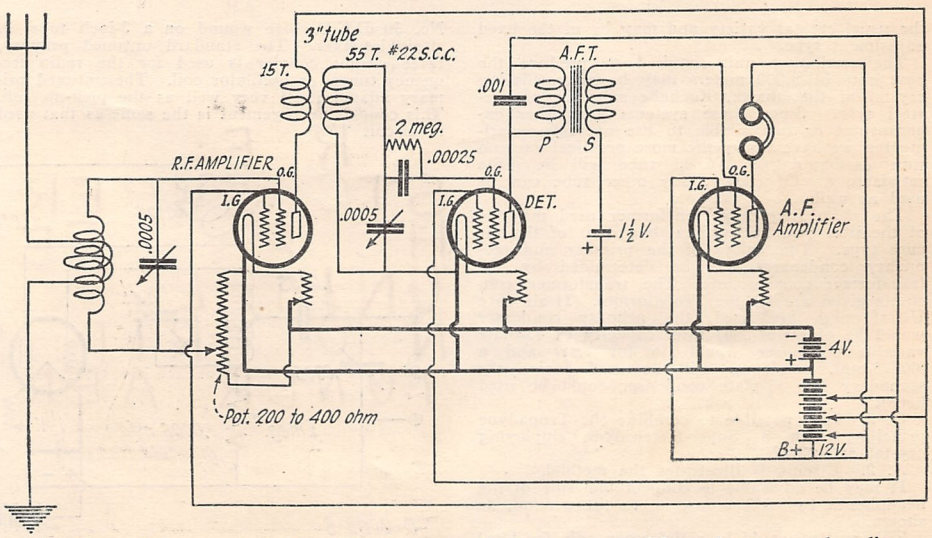
A. 2. A Lavite resistance should prove satisfactory in this position.

Q. 3. Is it true that the buzzer test is not always the best way of locating a sensitive spot on a detector crystal?

A. 3. Many times the test buzzer signals will be received clearly, while station signals cannot be received satisfactorily without a readjustment of the detector.

Also, a station may be heard very satisfactorily and yet the test buzzer may not be heard with maximum intensity.

Sometimes different stations will be received best at different points on the crystal.




Q. 2080: The use of double grid tubes as radio frequency amplifiers, detectors and audio frequency amplifiers is clearly shown. Solodyne tubes might work in this circuit.

### CONSTRUCTION OF CONDENSERS

(2082) Mr. Roger G. Cooper, Fredericton, N. B., Can., asks:

Q. 1. Can radio frequency amplification be added to a Flewelling receiver?

A. 1. It has not been successfully accomplished as yet. It may be physically possible to do so.

Q. 2. Does the filament of the UV-200 tube consume 5 watts in one second, one minute, or one hour?

A. 2. In one hour.

Q. 3. Would there be any saving over the list price of a ½ mfd. condenser, if same was constructed?

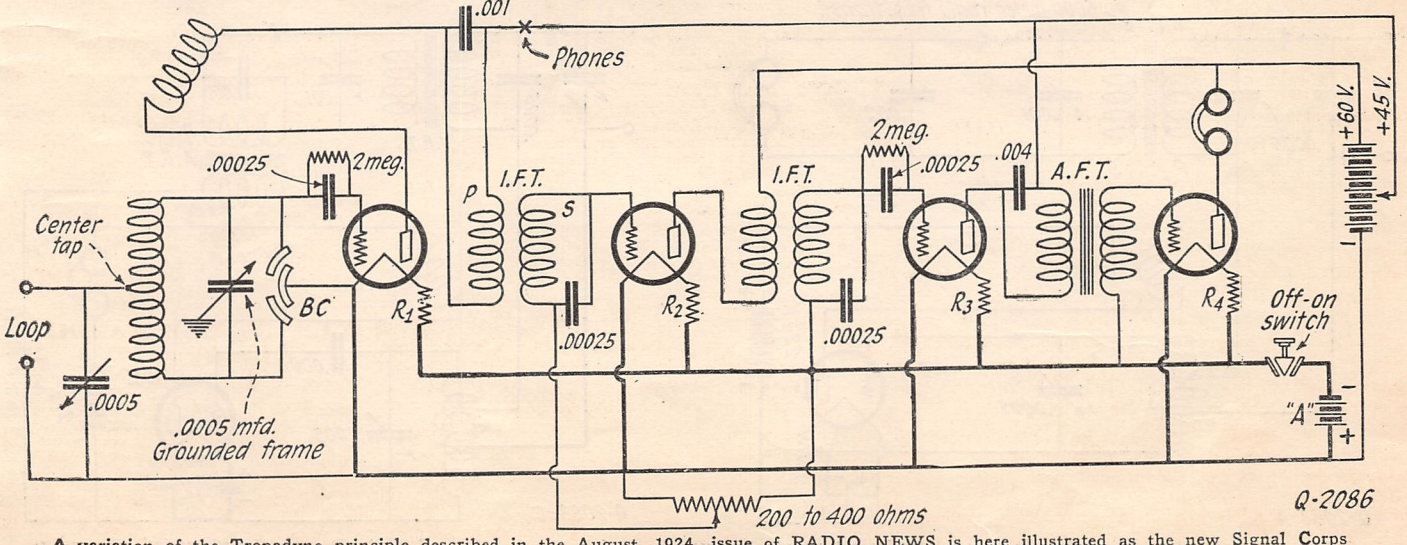
A. 3. These condensers are now manufactured in such an efficient manner that production costs are very low, resulting in a low retail price. We would not advise you to construct a condenser of this size under these conditions.

### ONE TUBE SUPER-HETERODYNE

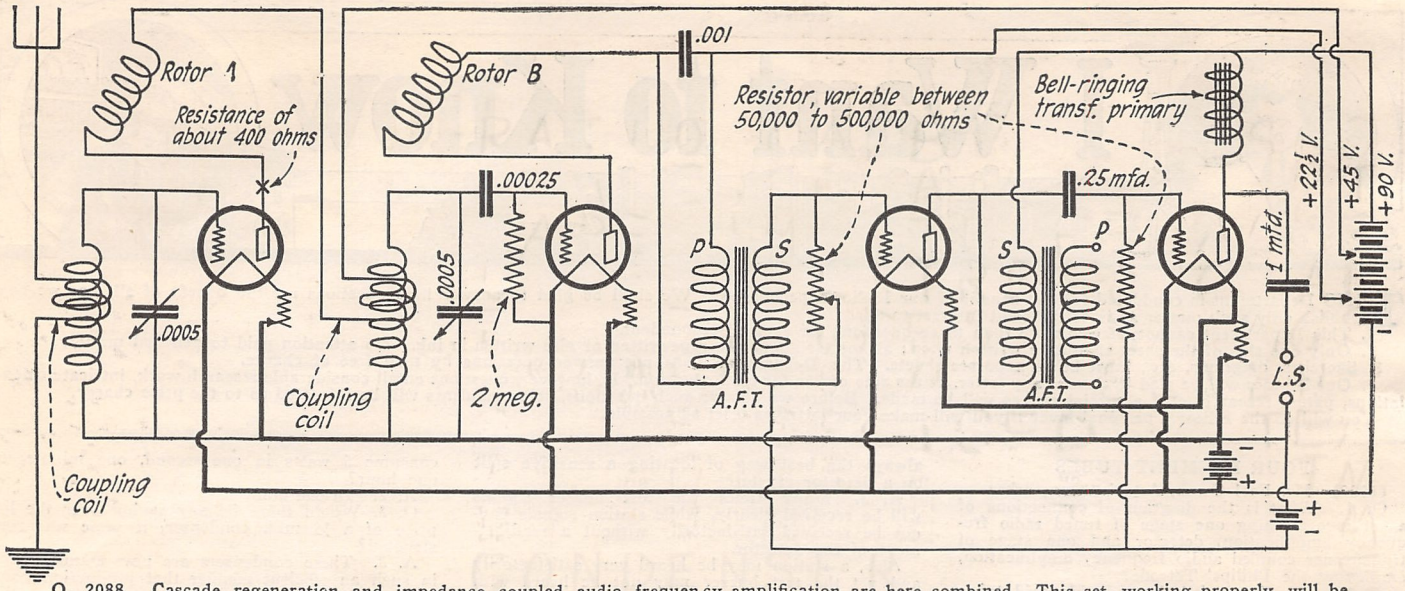
(2083) Mr. Lorne Machean, Bellevue, Chateauguay Co., Que., Canada, asks:

Q. 1. Is it possible to construct a Super-Heterodyne in such a manner as to eliminate vacuum tubes?

A. 1. Diagram A shows the most practical method of doing this. The two detectors are of




A variation of the Tropadyne principle described in the August, 1924, issue of RADIO NEWS is here illustrated as the new Signal Corps Super-Heterodyne. Additional stages of intermediate frequency amplification may be added if desired.




**Q. 2088. Cascade regeneration and impedance coupled audio frequency amplification are here combined. This set, working properly, will be much better than most 5-tube sets. Note the loud speaker connections.**

the usual crystal variety and may be of the fixed adjustment type.

The oscillating unit required to produce the beat note of 5,000 meters may be an oscillating crystal of the quartz, Rochelle salts, or zincite-steel type. Since these systems are either experimental or unavailable to the average experimenter, we have shown the more practical vacuum tube oscillator. A WD-11 tube will be quite satisfactory. Of course, any other tube can be used as well.

The radio frequency transformer used may be of the iron core variety, as shown, or of the air core type. The values of the primary and secondary condensers will be determined by the transformer construction. The transformer constants given are for the Tropaformer. If air core Ultraformers are used, the primary condenser would be of about .001 mfd. capacity (a 43-plate variable condenser would do for test) and a .00025-mfd. condenser will be used across the secondary (an 11-plate condenser could be used here).

Q. 2. Is it possible to combine the Tropadyne principle, with a Super-Heterodyne employing crystal detectors?

A. 2. Circuit B illustrates the method.

It may be advisable to connect one side of the headphones to "A" minus, or to the ground, as shown.

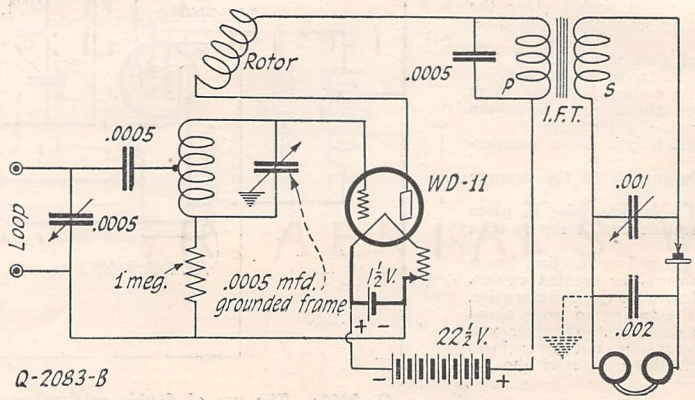
This system would be satisfactory only for local reception, using a loop aerial.

Since the lower potential side of the oscillator condenser is at a higher potential than "A" minus, it is necessary to use a grounded frame condenser. This will entirely eliminate the hand-capacity otherwise present.

A standard variocoupler may be used for the two tuning inductances shown. If a three coil coupler is used, the untuned primary is left unconnected.

Q. 3. What would be the circuit for reflexing the oscillator tube for one stage of audio frequency amplification?

A. 3. Circuit "C" is the theoretical circuit. The choke coil consists of about 300 turns of No. 30 D.C.C. wire wound on a 3-inch tube, in a single layer. The standard untuned primary, three circuit coupler is used for the radio frequency tuner, or oscillator coil. The untuned primary adapts itself very well as the pick-up coil. This coupler arrangement is the same as that used in circuit "A."




Q-2083-B

These three diagrams (A, B and C) will enable anyone to construct a one-tube Super-Heterodyne. The intermediate frequency transformer, primary and secondary must be tuned to exactly the same wavelength.

The ratio of the audio frequency transformer may vary between 3:1 and 10:1.

It may be necessary to experiment with this circuit before it tunes sufficiently sharp and is sufficiently sensitive.

## SOLDERING

(2084) Mr. LeRoy Johnson, Aberdeen, N. C., asks:

Q. 1. Can the use of acid-core solder be the cause of a set not functioning properly?

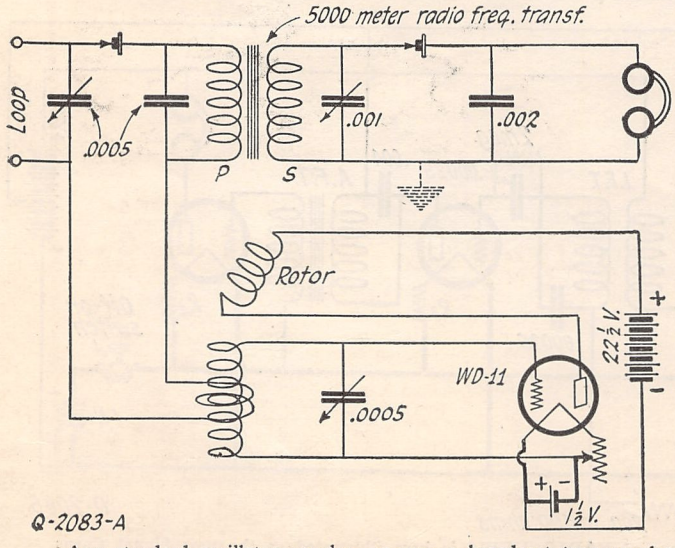
A. 1. Possibly. It depends somewhat upon what is being soldered and the way in which the soldering is done. In general, it is very inadvisable to use acid flux for any kind of soldering in connection with radio apparatus.

Q. 2. What would be a satisfactory method for soldering radio instruments and wiring?

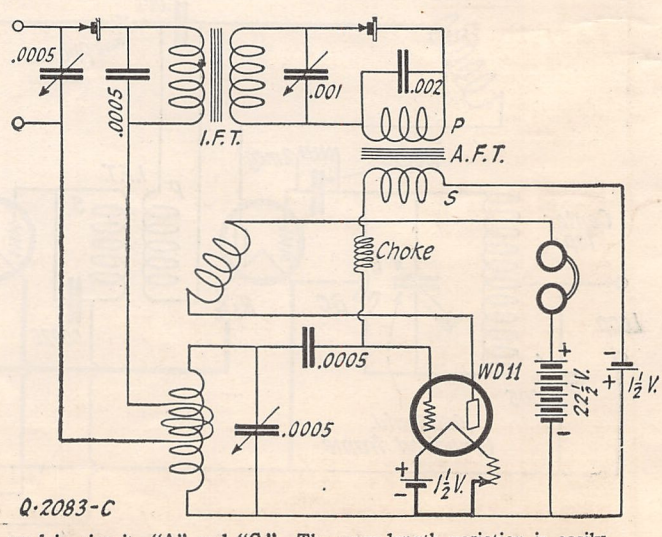
A. 2. First, have a real hot soldering copper (called a soldering "iron"). This "iron" should not be allowed to turn red, as this causes the "tin" to burn off. To make a satisfactory connection the hot iron should be applied to the work, so as to heat the work before the solder is applied. When the solder on the iron seems to be taking hold of the surface to be soldered, the solder can be applied. If a resin core flux is used, no other flux is usually necessary to make the solder stick.

In order for the iron to work properly it is necessary that it be well "tinned." The simplest way to make sure of this is to have a large sheet of tin handy, also a jelly glass of muriatic

(*Continued on page* 1440)




Q-2083-A




Q-2083-C

**Any standard oscillator coupler, or even a broadcast type coupler, may be used in circuits "A" and "C." The wave-length variation is easily controlled by increasing or decreasing the number of turns in the grid circuit of the oscillator tube. The loop condenser must be of low loss type. Do not use a phone plug for loop connecting.**

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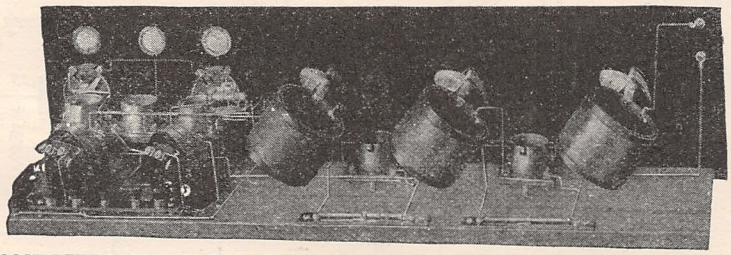

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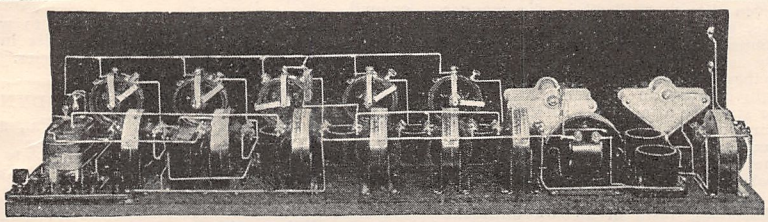

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1 Remler or Columbia Tuned Circuit Transformer
1 Special Oscillator Coupler
1 Midget Condenser
8 Bakelite Sockets
2 Thordarson or Columbia A.F. Transformers
1 Connecticut Filament Switch
2 Bakelite 6-ohm Rheostats
2 Bakelite 30-ohm
1 Bakelite Potentiometer, 400 ohms
1 Carter Double Circuit Jack
1 Dubilier 1 mfd. Condenser
1 .006 Mica Condenser
1 .0005 Mica Condenser and 2 megohm Grid Leak
3 .0025 Mica Condensers
10 Binding Posts
1 .00025 Mica Condenser
1 Bakelite Terminal Strip for Binding Posts
1 Multicord cable for connecting batteries
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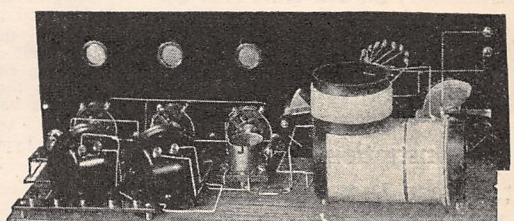


**COMPLETE PARTS FOR 3-TUBE**
**Cockaday Receiving Set**
1 Cockaday Coil
2 23-Plate Hy-Grade Cond.
1 Bakelite Rheostat, 6 ohm.
2 Bakelite Rheostat, 30 ohm.
3 Bakelite Sockets
1 high ratio Columbia or Thordarson Transformer
1 Single Circuit Jack
1 low ratio Columbia or Thordarson Transformer
2 Double Circuit Jacks
2 3 in. Bakelite Dials.
1 Grid Leak and Mica Cond.
7 Switch Points. 2 stops.
1 Bakelite Binding Post Strip
7 Binding Posts
1 7x21x3/16 in. Drilled Bakelite Panel
3 Bezels
1 Baseboard
1 switch lever
24 ft. Hook-up Wire
**$19.95**
Complete blue-prints and wiring diagrams.
**1-Tube Set..... $10.45**

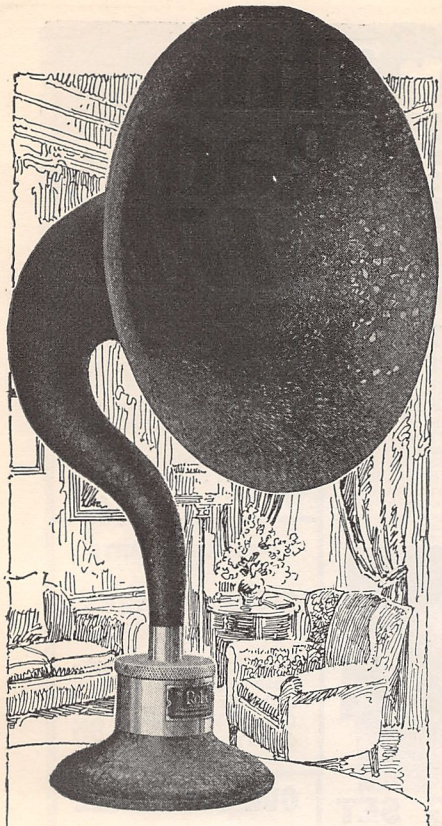
**Easy to Build Your Own Radio Set**
All complete parts for sets on this page consist of **standard advertised guaranteed parts** and include **drilled bakelite panels** and **wiring diagrams** for easy set construction.
Everything guaranteed on money-back basis. All transportation charges paid. **Don't forget!** Only genuine guaranteed parts used. Lack of space does not permit us to itemize individual parts, but you are fully protected by our money-back guarantee. **Our Service Division is behind you.**

**FREE BIG MONEY SAVING RADIO CATALOG**
containing a thousand bargains of everything on radio—parts, supplies, complete parts for sets, complete sets, etc., also a mine of very latest information on all different circuits, complete list of broadcasting stations, and other valuable, up-to-the-minute radio data. Send your name and address on a card or letter. We will send catalog free.

**Free Service Department**
Our radio engineers will help you solve all your radio problems, and furnish up-to-date information on set construction, operation and improvement. This service is **free** to our customers.

**COMPLETE PARTS FOR**
**5-Tube Improved Cockaday Receiving Set**
**With Resistance Coupled Amplification**
As designed by L. M. Cockaday.
Including drilled panel and wiring diagram complete, ready to wire.
**$39.65**

**RANDOLPH RADIO CORPORATION**
**159 N. Union Ave. Dept. 337 Chicago, Illinois**



Rola

ACHIEVEMENT—

A NEW STANDARD in radio reception has been achieved in the Rola Re★Creator.

Exquisite tone quality—master of every note in the orchestral range. Sensitivity that will reproduce any signal that can be amplified. Volume unequalled—without chatter, without discord.

A demonstration is the acid test. Hear the Rola at your dealer's for convincing proof.

PRICE COMPLETE WITH FOURTEEN-INCH HORN & CORD
$36.00

PHONOGRAPH UNIT WITH ADAPTOR
$22.50

*A Product of*
THE ROLA COMPANY
SEATTLE, WASHINGTON · USA

Distributed nationally to the jobbing trade by BAKER-SMITH COMPANY, L. C. Smith Building, Seattle, Washington, *with offices in the principal cities*


# I Want to Know

(*Continued from page* 1438)

acid which has been "killed" by the addition of sufficient scrapings of zinc to prevent the further formation of bubbles when more zinc is added. By heating the iron to almost a red heat, then quickly dipping it into the acid, the iron will readily become coated with a film of solder, when the iron is rubbed around on the sheet of tin, on which are pieces of solder. A file sometimes assists the process. No flux is used in this operation, the acid treatment being sufficient for the purpose. When all sides of the iron have become coated with a film of bright solder, the iron is "tinned" and is ready for use; without the tinning, solder will not stick to the soldering copper and the soldering copper will not heat the work.

Beware of soldering "pastes." They sometimes cause more harm than good. There are several good soldering pastes on the market, but they must be used judiciously. An excess may form a leakage path just where it is not wanted. A little care and thought will be all that is necessary. Capillary attraction sometimes causes conducting fluxes to creep into undesirable places. Sometimes, too, it will spatter into the wrong spot.

Acid flux, even though "killed" in the manner described above, is not desirable because it often causes poor connections to develop, due to a slow corrosion. On small work, such as soldering wires, smaller than size 30 B. & S., it often eats entirely through, causing an open circuit.

Salammoniac strongly attacks the soldering iron, quickly rendering it unfit for use.

The best flux, resin (pronounced, "rosin"), may be used as the core of the solder, as mentioned in the first paragraph, or it may be made into a convenient solution, as desired. The solution is made by dissolving resin in alcohol until the desired density is secured. It is applied with a brush and the soldering is done immediately. In either case, excess resin should be removed with alcohol and a brush or cloth, after the soldering is completed.

If the work to be soldered is easily movable, see that no motion takes place until a few seconds after the solder has clouded. If thick metals are being soldered, the pieces should be held immovable until the solder has thoroughly hardened.

When the job is done, move the pieces to see if the union is perfect. A juncture seemingly perfect can cause much inconvenience if it is not so.

Keep the iron clean and have a cloth handy for this use.

Q. 3. What are the characteristics of the Magnavox Type A tube?

A. 3. Filament voltage, 5; amperage, .20 to .25 amp. Plate volts, 60 to 120. Amplification constant, 8 to 12. Mutual conductance, 800 to 1200 micromhos. Standard base. It is a three-element tube with an unusual design of grid.

## FUNDAMENTALS

(2085) Mr. W. Kellow, Alhambra, Calif., asks:

Q. 1. Which way does the modulated current flow in the plate circuit of the detector, that causes the audible notes in the phones?

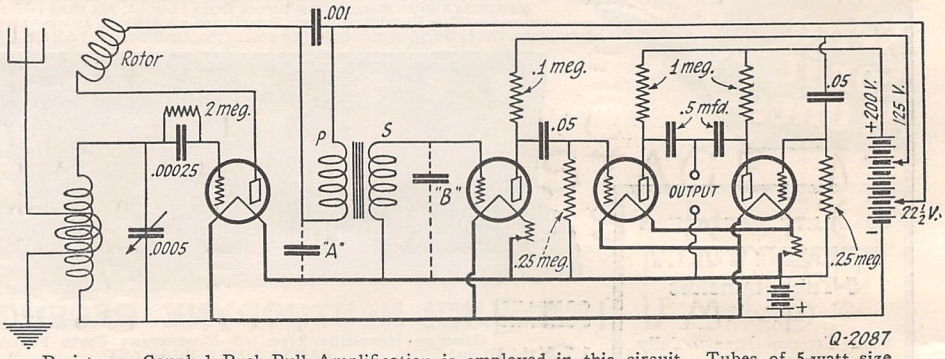
A. 1. The plate, or "B" battery, current can move only very slowly from the plate to the filament, until a signal comes in, when it quickly moves from plate to filament, in the vacuum tube, in unison with the signal variations, producing a pulsating direct current through the headphones.

Q. 2. Which way does the relative current flow in the grid circuit?

A. 2. From the grid to the filament, in the vacuum tube, since it is prevented from going in the other direction, due to the one-way, or valve, action of such tubes.

Q. 3. Please explain whether or not the half-cycle in the plate circuit comes from aerial or ground.

A. 3. The audio frequency half-cycle to which you refer is the sum of many full cycles in the aerial circuit occurring at radio frequencies.




Resistance Coupled Push-Pull Amplification is employed in this circuit. Tubes of 5-watt size will be better than the usual type for the power tubes. Use a plate voltage of 500.

## SIGNAL CORPS SUPER-HETERODYNE

(2086) Mr. M. E. Rachael, Dunlo, Pa., asks:

Q. 1. What is the Diode tube?

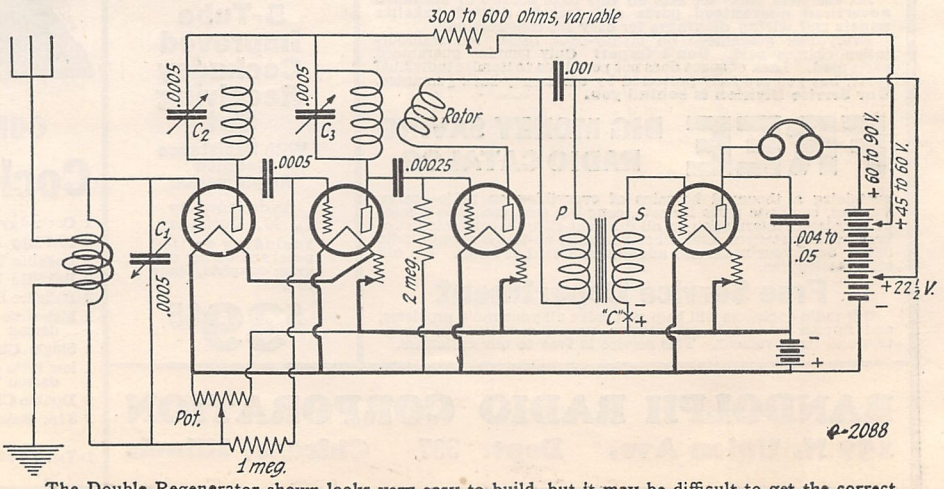
A. 1. This is a vacuum tube having only two elements—filament and plate. It is technically known as the Fleming valve, in honor of the inventor.

Q. 2. Will you kindly show the Signal Corps Super-Heterodyne circuit attributed to Jackson Pressley?

A. 2. We are showing the circuit in these columns. An oscillator, center tapped, is used having the correct values for the intermediate frequency transformers and loop used. The I. F. T. condenser values shown are correct for Ultraformers. Since the oscillator variable condenser is always at higher-than-ground potential, a grounded-frame condenser will be required to eliminate hand capacity.

The balancing condenser, BC, is adjusted in the following manner. Place the headphones in the circuit of the oscillator tube at "X" and place the oscillator dial at about the middle of the range. The loop tuning condenser and balancing con-

(*Continued on page* 1542)




The Double Regenerator shown looks very easy to build, but it may be difficult to get the correct angular relation and inductive values for best operation. Use good parts.

# The instrument for you—if you are particular

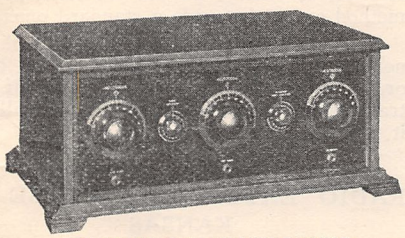
ROYAL ELIZABETHAN—Model 150

Combination phonograph and radio. Walnut or mahogany. Price $350 with loud speaker, less accessories. Without Neutrodyne Set and loud speaker price $175.

ADLER-ROYAL NEUTRODYNE

Floor Type No. 1 Elizabethan

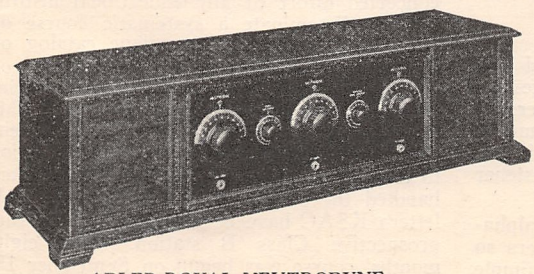
Dry cells or wet "A" Batteries. 5 tubes. Walnut or mahogany. Price $350, including loud speaker, without tubes or batteries.



ADLER-ROYAL NEUTRODYNE

Model 201A Table Type

To be operated with "A" storage batteries; "B" batteries concealed in cabinet. 5 tubes. Walnut or mahogany. Price $160. Complete with accessories $215.



ADLER-ROYAL NEUTRODYNE

Model 199 Table Type

Used with dry cells. Batteries concealed in cabinet. 5 tubes (199). Cabinets walnut and mahogany. Price $165. Complete $205.

*You will surely find it in this beautiful line of Royal radio and phonographs*

THERE is an instrument in the Royal line of radio and phonographs that will not only meet your wishes for better home entertainment but also give you exactly the enjoyment you desire. Whether you want to hear the programs of the radio broadcasting stations or the most beautiful records, a Royal instrument will reproduce the tones perfectly.

Royal gave to the public a better phonograph which thousands welcomed for its superior tone and beautiful cabinet designs. Now in Adler-Royal Neutrodyne it has simplified radio so that any one can operate it. Merely by setting the dials at certain numbers the radio stations are brought in without the discordant noises that have been associated with some types of radio. You have your choice of two different styles. Set 201-A operates with the usual "A" storage battery. Set 199 operates on dry cells.

Adler-Royal is on exhibit only at the higher class stores whose reputation is an additional guarantee of the quality of the Royal line.

You will be only fair to yourself if you examine the Royal line and compare it with all others in quality of workmanship, tone reproduction and price.

ADLER MANUFACTURING COMPANY, INC.

*General Sales Office*: Dept. R.N.2, 881 Broadway, New York City

*Factories*: Louisville, Ky.

**ROYAL**

*Phonograph and Radio*

Licensed by Independent Radio Manufacturers, Inc. Reg. U.S. Pat. Off. NEUTRODYNE Pat. March 27 1923 and April 1, 1924 Hazeltine Pats. Nos 1450,080 and 1,493,228 Other Patents Pending.

*The Adler-Royal Neutrodyne is licensed under the Hazeltine Neutrodyne Patents and manufacturd for us by King-Hinners Radio Company.*

ADLER MANUFACTURING COMPANY
881 Broadway, New York City, R.N.2.

Please send me the Adler-Royal illustrated booklet and log.

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*Address* .....

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*holds a future for you*

*Radio Designing*

**The limitless field of radio — growing by leaps and bounds — daily opens up new opportunities for success. And here is your opportunity to qualify for a good position — with substantial pay and a chance to grow with radio.**

**STUDY RADIO AT HOME**

You do not have to give up your present employment. The Radio Institute of America—the world's oldest radio school—with 7,000 graduates—now offers a *new and completely revised* HOME STUDY COURSE in radio that will prepare you to successfully pass the U. S. Government examination for a Commercial Radio License.

**RADIOLA III — FREE with course**

An omnigraph, a buzzer set, up-to-date text-books, and *Radiola III with two tubes and Brandes Headset* are free with the course. These are the best text-books and apparatus obtainable.

The Radio Corporation of America conducts the school. The largest radio companies give employment preference to our graduates because of their superior training. Mail the coupon today for more information.

**Radio Institute of America**

(*formerly Marconi Institute*)
Established in 1909

324 Broadway New York City

Radio Institute of America
324 Broadway, New York City

Please send me full information about your Home Study Course of radio instruction.

☐ I am interested in the complete course including code instruction.

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.....


# What'll I Do When I Can't Get the Call?

By CARL H. BUTMAN

THE other night I sat through two long numbers rendered by what appeared to be a new and distant station, only to miss the call letters voiced by the announcer as "Station W Blah Blurr Blam." How many fans have had the same trying experience? The answer lies in the query columns of the daily papers and in the radio magazines.

There are listeners who can distinguish between WDAF and WEAF, which are both on wave-lengths over 400 meters, but few are certain whether an announcer says: "WGY" or "WGI"; one on 360 and the other 380 meters?

Fans are kicking on the enunciation of many radio broadcast announcers, their apparent carelessness in signing off, the slurring of the call letters and the infrequent repetition of the distinguishing call or name, during an evening's program. Listeners fail to log many stations they hear, and are disappointed. Failure to get the call letters or the station name and location, especially among the DX fans, brings hundreds of complaints or inquiries to the radio editors, as to what station was transmitting a selection at a certain time on a specific night. These queries are the bane of the radio editor's existence, for in order to answer them their publication seeking the aid of other fans is often necessary. Such complaints also show that some stations are failing to gain new listeners, which defeats their primary object. After all, it is for the fans that broadcasting is undertaken, so they must be catered to.

The DX folks file special complaints that brief announcements by call letter, owner and city are not made before and after each selection, for identifying purposes. They point out that nothing discourages them so much as to pick up a station which they are unable to identify within a few minutes. They object to waiting a half hour, especially when they are searching for a specific station.

The fault lies chiefly with announcers who do not enunciate slowly and distinctly, with a pause between letters or names. While some are unusually good, many seem bored when giving their calls and rush through the letters probably in an effort to get to the next selection announcement. Over the air many letters sound exactly alike. It is difficult to differentiate between the sounds of Y and I, P and B, D and G, C and Z, and S and F. Station WTAS has solved this to a certain extent by its soubriquet "Willie, Tommie, Annie and Sammie." Others use pertinent slogans or phrases which fans soon learn. However, some standard method of positive indentification seems necessary.

### IDENTIFYING THE CALLS

Without going into as complicated and embarrassing a plan as one fan suggests—a school of enunciation for broadcasters or carrying criticisms in a separate column in daily papers, it is believed that the significant letters could be transmitted to the listener by one of the following plans.

In the Navy every officer learns an alphabet composed of words instead of letters so there can be no mistake when this simple code is used. Under this plan, "Affirmative" represents the letter A, "Baker," B; "Cast," C; "Dog," D, etc. Applying this plan to broadcast announcing, the speaker might say: "This is station W R C—William, Roger, Cast," using the representative words, or the KGO announcer might say "This is station King, George, Optional. The Signal Corps uses "Ack" for A, "Bough" for B, "Caw" for C, and "Dan" for D. Perhaps, however, a simpler set of words might be chosen by the stations themselves, but the government word alphabets have been used and improved until it is practically impossible to confuse two words even if half the letters or sounds are missing.

Another method is one familiar to all commercial operators and many amateurs—the "Dah-dit" method of transmitting the letters in code, which would soon be learned and remembered. WNYC would be announced as such by letters followed by "Dit dah dah, Dah dit, Dah dit dah dah, Dah dit dah dit."

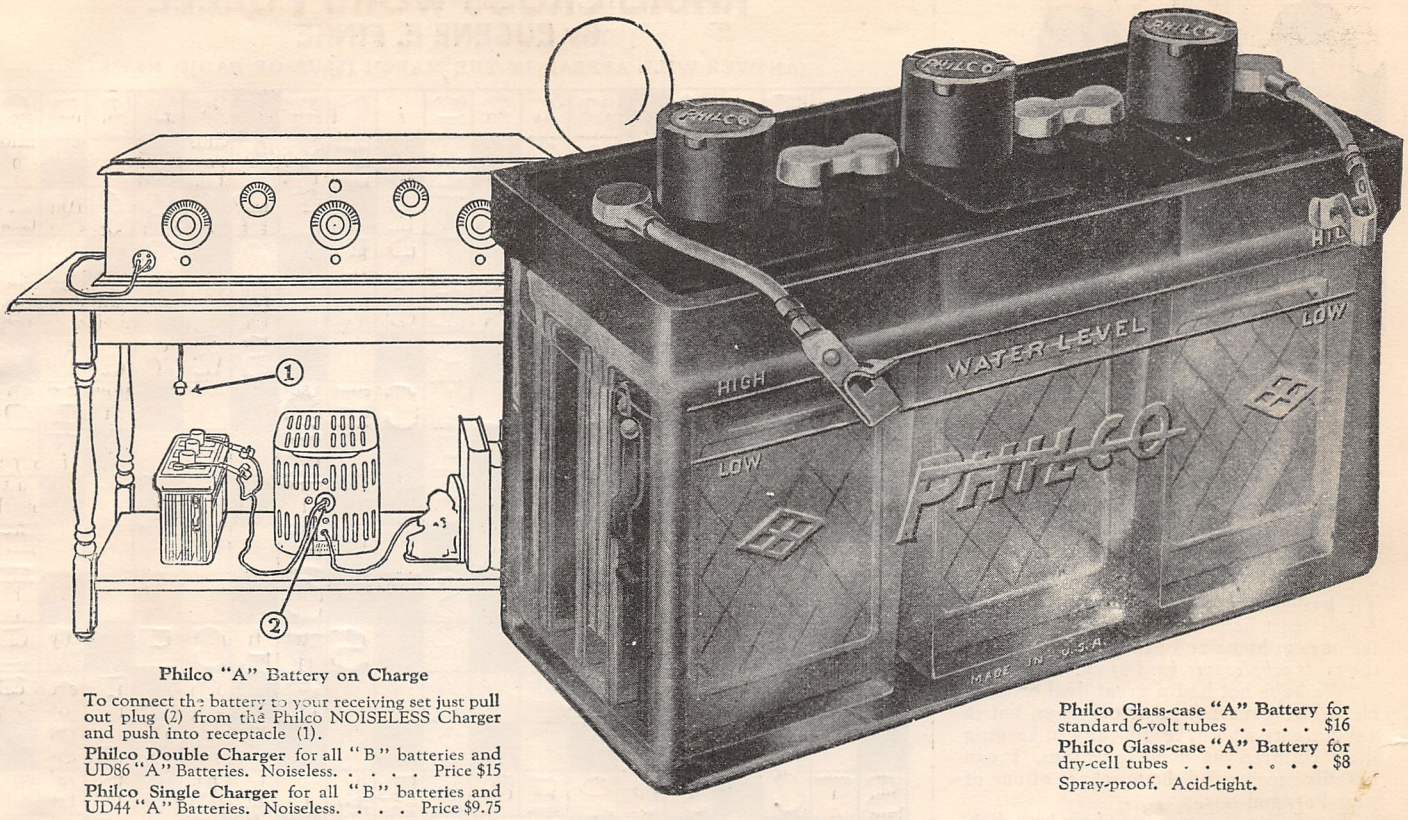
While in the office of the Chief Supervisor of Radio the other day, a radio editor in Philadelphia called up and asked for the call letters of some stations. They were given regularly but checked back by the radio code. Although he failed to get some of the letters spoken by the first method, he repeated them correctly when the speaker in Washington transmitted them by voice code, so to speak.

Recently L. E. Corridon, the clever call-letter assigner of the Department of Commerce has done his best to give broadcasters call letters carrying some significance. Most of us know that WRC is the Washington Radio Corporation station; and that WNYC is indicative of Wireless, New York City. A few may have noticed that WREO bore some relation to the Reo Motor Company, and that WGBS, might be dubbed "Wireless Gimbel Brothers Store." Atlantic City's new broadcaster will probably have call WGP, intended to carry out the slogan; "World's Greatest Playground," as WGN is supposed to stand for "World's Greatest Newspaper." No one would miss WCCO, once it was known to stand for Washburn-Crosby Co., or WEBH, Wireless, Edgewater Beach Hotel. However astute the call assigner may be, he can not hope to fulfill all requests for significant initial letters nor to change all the old calls, so this method cannot be made a standard one.

Something must be done to school announcers in pronouncing their station calls, or aid them in putting the name of the transmitting station over so we can all get it the first time.

## RADIO EXTENSION COURSE IN KANSAS

THE Kansas State Agricultural College is broadcasting a radio extension course in agriculture, engineering, home economics and general science. This plan was the first concerted effort of any educational institution to disseminate a systematic course of instruction by radio, the unique catalog of this air college claims. All departments of the college have co-operated in the aerial programs outlined and the new 500-watt broadcast station at Manhattan, Kan., went on the air about the first of the year. Prior to that date, however, KFKB at Milwaukee handled the program on 286 meters. Call letters KSAC have been applied for by this prospective Class B station. The eight months' course was begun on September 15, and will terminate about April 24, 1925. Those who desire to enroll should correspond with the Extension Division of the Kansas State Agricultural College at Manhattan. Examination papers will be mailed at the close of each course and must be returned within 30 days. Students who pass will be awarded certificates. The cost is nothing, except to scholars outside the state, who must pay a fee of fifty cents a course.




**Philco "A" Battery on Charge**

To connect the battery to your receiving set just pull out plug (2) from the Philco NOISELESS Charger and push into receptacle (1).

**Philco Double Charger** for all "B" batteries and UD86 "A" Batteries. Noiseless. . . . . Price $15

**Philco Single Charger** for all "B" batteries and UD44 "A" Batteries. Noiseless. . . . Price $9.75

Charger Prices include plugs and receptacles.

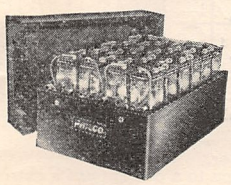
**Philco Glass-case "A" Battery** for standard 6-volt tubes . . . . $16

**Philco Glass-case "A" Battery** for dry-cell tubes . . . . . $8

Spray-proof. Acid-tight.

# Just a plug in a socket

## *and your Philco is on charge!*

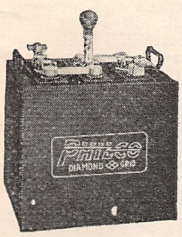


**Philco "B" Battery**

Storage "B" Batteries are just as essential for clear and distant reception as storage "A" Batteries. Philco "B" Batteries stay clean and dry. Charge without disconnecting a single wire. Use a Philco Charger and "B" Charging Panel ($2.75).

With de luxe mahogany-finish case with cover (48 volts) . . . . . $20

With handsome mahoganized case without cover (48 volts) . . . . . $16.50



Philco Mahoganized-Case "A" Batteries

Two types—RAR and RW—for 6-volt tubes. Both in beautiful Adam-brown mahogany-finish cases harmonizing with your radio cabinet. Price . . . . . $14.50 up

**Philco Charge Tester**—permanently mounted in filler cap, avoids fussing with hydrometer, $1 extra.

Recharging a Philco Radio Battery with a Philco NOISELESS Charger means merely pulling a plug from your radio socket and pushing it into the charger socket. See sketch above.

No changing wires. No moving the battery. No worry about burning out tubes by getting positive and negative wires mixed.

Philco Radio Batteries—both "A" and "B"—have other big advantages that make storage battery operation easy, convenient and economical.

They are assembled in attractive acid-tight, spill-proof glass cases—or in wood cases finished in beautiful Adam-brown mahogany. They have exclusive built-in Charge Indicators that tell you at a glance how far the battery is charged or discharged.

No matter how expensive your radio set—whether it has one tube or many tubes—you must have the steady voltage and strong non-rippling current of a good STORAGE BATTERY for the best results.

Philco Radio Batteries deliver strong, non-rippling current ***without hum, roar or buzz.*** You can buy them from your nearest Philco Service Station, Radio or Music Dealer.

Philadelphia Storage Battery Company, *Philadelphia*

**PHILCO** DRYNAMIC RADIO BATTERIES

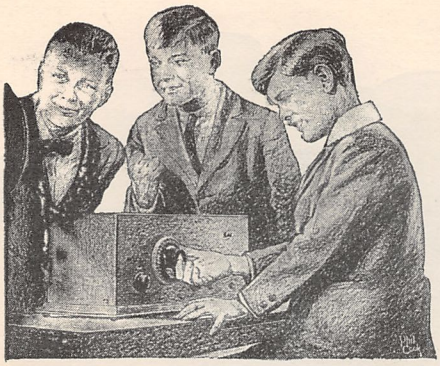
REG. U.S. PAT. OFF.

**JOBBERS *and* DEALERS**—Philco has brought radio batteries out of the cellar and put them in the living room. Our new Radio Manual tells how. Fill out coupon below and we will mail you a copy.

*Name*.....

*Street*..... *City*.....

*State*..... *Jobber* ☐ *Dealer* ☐



# The Parents' Problem

***A business man in Utah wrote us this letter, unsolicited. We print it because there's a real thought in it for every parent.***

"IT has occurred to me that radio is one of the most helpful means of entertaining the boys at home and providing them with the *most wholesome kind of entertainment.*

"We have not had a great deal of trouble in the government of our boys, but to any parents who have difficulty in keeping their children at home evenings, I can heartily recommend the purchase of one of your Paragon sets.

"For Christmas I gave two of my boys, Robert and Joe, a Paragon Radio Set. They are having very delightful times with it almost every evening. I frequently find them with a crowd of other boys around it enjoying the concerts from various broadcasting stations of the country.

"There is a great deal of criticism as to various other public entertainments, but I have as yet to hear over our radio anything that could be criticized by anyone."

♧ ♧ ♧

FOR young folks as well as older ones the new Paragon Four is an ideal radio receiver. So simple to operate—one single dial does all the tuning. May be used with any standard tubes—dry or storage battery type. So clear and strong in tone—even on distant stations with loudspeaker. Built round the new Paradyne Circuit—non-radiating.

And, furthermore, so low in cost. Hardly one-third the price you'd expect to pay for such quality.

If your dealer in radio is not yet showing this new set get in touch with us.

ADAMS MORGAN COMPANY, INC.
18 Alvin Avenue Upper Montclair, N. J.

THE NEW
PARAGON
REG. U.S. PAT. OFF.
FOUR
$65

Four tubes. Paradyne Circuit. Loudspeaker volume over practically unlimited range. Handsome mahogany cabinet, 21 inches long.

**The New Paragon Three $48.50**

Three tube set of amazing loudspeaker volume, tone, and range. Single dial control.

**The New Paragon Two $27.50**

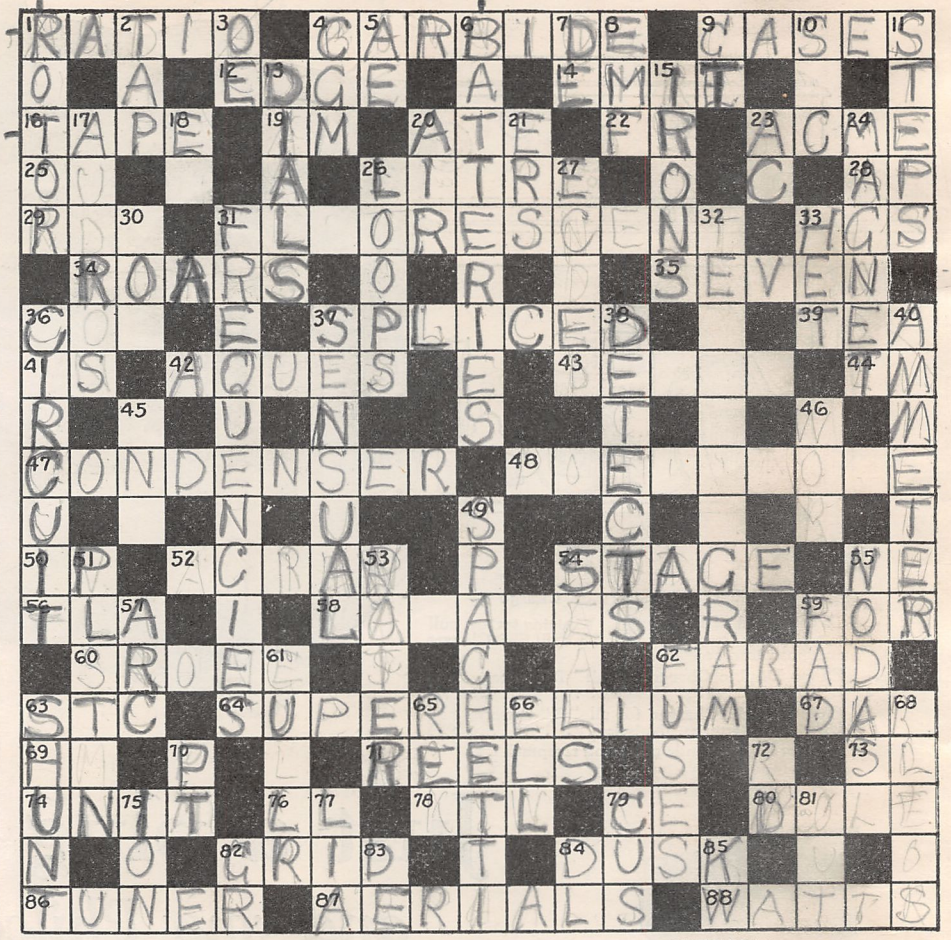
Excellent loudspeaker volume over moderate range. Perfect phone reception over unlimited range. Two tubes. Single dial.

***Write for free Descriptive Folder***


# RADIO CROSS-WORD PUZZLE

## By EUGENE E. FINKE

(ANSWER WILL APPEAR IN THE MARCH ISSUE OF RADIO NEWS)



### HORIZONTAL

1. A transformer of energy.
4. Metallic compound of carbon.
9. Helium, oxygen, argon.
12. The side of a panel.
14. Discharge.
16. An insulating binder.
19. Part of the verb "to be."
20. Consumed.
22. Dit dit dah dit, dit dah dit.
23. Highest point.
25. Element used in rectifiers. (Symbol.)
26. A metric unit.
28. An old type of vacuum tube.
29. A shellac.
31. Showing a light of different color than its own when illuminated.
33. Cinnabar. (Symbol.)
34. What a loud speaker often does.
35. Between 6 and 8.
36. Manganese carbide. (Symbol.)
37. Two joined wires.
39. A beverage.
41. Dit dit, dit dit dit.
42. Dit dah, dah dah dit dah, dit dit dah, dit, dit dit dit.
43. The function of a wave trap with regard to interfering waves.
44. Dah, dah dah.
47. Apparatus for collecting and holding electricity.
48. Either terminal of a battery.
50. Input. (abbr.)
52. Odor arising from a shorted "B" battery.
54. A well-defined degree, as of amplification.
55. A compass point.
56. Telegraphers' Linemen's Association. (abbr).
58. Makes a line in.
59. Pro.
60. Sparkled.
62. Electrical unit of capacity.
63. Submarine telegraph cable. (abbr.)
64. Helium given greater power than ordinary helium.
67. A measure of length.
69. Helium. (Symbol.)
71. Rotary devices for winding wire.
73. Silicon. (Symbol.)
74. A coulomb, ampere, volt, etc.
76. Dit dah dit dit, dit dah dit dit.
78. A Chicago broadcast station.
79. Civil Engineer. (Degree.)
80. 119.38 sq. yards. (pl.)
82. Place where seepage of current occurs.
84. When the bedtime stories are broadcast.
86. Tuning instrument.
87. Antennae.
88. Joules per second.

### VERTICAL

1. A conductor.
2. A connection to a coil not at its extremities.
3. An expert in the radio field. (abbr.)
4. The metric equivalent of the F.P.S.
5. One.
6. Used with most radio sets.
7. From.
8. The force starting electricity in motion.
9. Dah dah dit, dah.
10. Carborundum. (abbr.)
11. Stages.
13. Graduated circular plates.
15. A metal. (pl.)
17. Automatic enunciator devices.
18. Electrical engineer. (Degree.)
20. Hydrogen, oxygen and nitrogen.
21. Dit, dit dah dit, dit dit dit.
23. Alternating current. (abbr.)
24. A body possessing a magnetic field.
26. A form of aerial. (pl.)
27. Enlarged.
30. To study a plan.
31. Rates of wave repetition.
32. A record made by writing or copying telegraph for reproducing at a distance.
33. Heterodyne. (abbr.)
36. The course traversed by an electric current.
37. Pertaining to earthquakes.
38. What a galena crystal does.
40. An instrument for measuring current strength.
45. A radio station in Kukak Bay, Alaska.
46. A broadcast station in Newark, N. J.
49. Insulating cambric tubing.
51. Part of a machine tool carrying the work.
53. Substance added to make paint dry.
54. Supplies with device to prevent return flow of a gas.
55. Having nodes.
57. Bow of flame between two electrodes.
59. Distance.
61. Having two parts.
62. Short circuit protectors.
63. To divert a part of a current.
65. A row. (obs.)
66. A measure of length.
68. Thin sheets forming core of a laminated armature. (pl.)
70. Platinum. (Symbol.)
72. Radium. (Symbol.)
75. A carrier of electricity.
77. Radio call letters of a Norwegian battleship.
79. Cupric sulphide. (Symbol.)
81. Groove.
82. Dit dah dit dit, dit dah dit.
83. Kinetic energy. (abbr.)
84. Duo-lateral. (abbr.)
85. One thousand watts.

*No. 770. 45-volt extra large vertical. For heavy duty only. The ideal "B" Battery for use on multi-tube sets. Price $4.75.*

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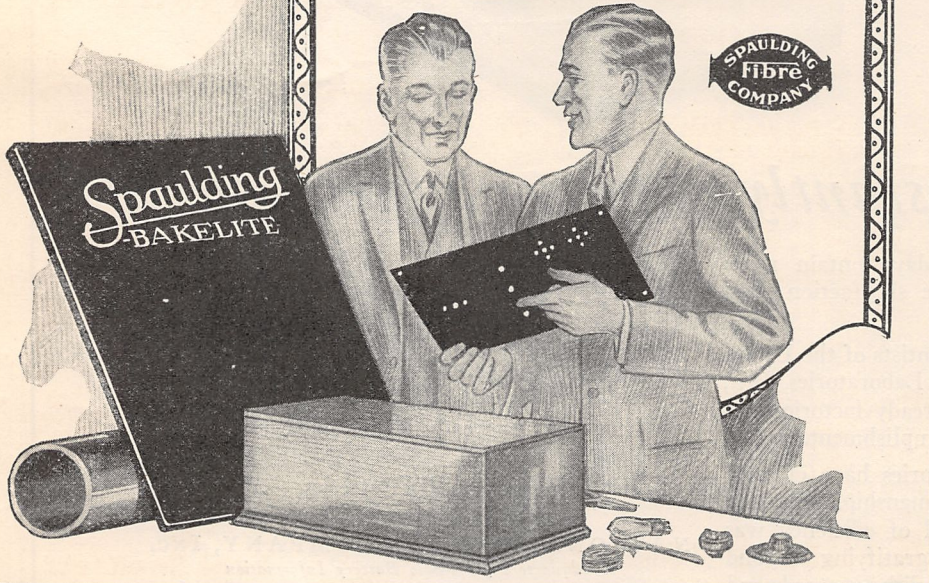



## From a British Marine Engineer

(*Continued from page* 1436)

With regard to KDTJ's (S.S. *Emidio*) letter, may I make a few remarks?

Like Mr. Howe, I too am in a position to hear broadcast programs from American, British and Continental stations, but I have at my disposal only a two tube receiver of the honeycomb coil type. It is entirely homemade and British material has been used throughout. I am not using radio frequency amplification. With this receiver I have no difficulty in getting good results from American, British and Continental stations at distances ranging from 2,500 to 5,000 miles. Starting in the Suez Canal with the London station 2LO, distant 2,300 miles, that station comes in clearly and distinctly all the way through the Mediterranean, right to the American coast. Many other B.B.C. stations come through very well. The high powered station of Radio-France at Paris is clearly audible in the daytime, up to a distance of 1,300 miles.

On the Pacific side, the stations WGY, KDKA and WEAF remain with us nightly, right up to San Pedro, Calif. The stations KGO, KPO, KFKX and CFCN are heard all the way across the Pacific to the Japanese coast, a distance of nearly 5,000 miles. No, Mr. Howe, this is not a freak receiver nor are they freak results, for I once had my receiver ashore and well inland in your country. The results there compared very favorably with the results obtained with similar American sets.

With a simple fixed crystal set I have obtained perfect results which compare (as regards distance) with yours. Yes, KDKA at 1,500 miles on a crystal is a very common performance on our ship.

These results can be verified by our Captain, Chief Engineer and others.

As I am not acquainted with commercial apparatus, I cannot comment on the remarks regarding land stations, but whether our radio apparatus and stations are behind the Americans or not, I *do* know our operators get there just the same, and we and the British public are satisfied.

Regarding the broadcast programs from the B.B.C. stations I like them; we all like them; also the American programs, especially those of KDKA.

J. W. Dawson,
5th Engineer, S.S *City of Oran.*

## REGARDING NAA AND NSS

*Editor,* Radio News:

Kindly permit me to broach the subject of NAA and the new tube transmitter there. Being a commercial wireless operator, I am of necessity much interested in either NAA or NSS while in Atlantic waters. Everyone aboard wishes to learn the news of the day while out at sea and NAA or NSS are two stations that we would all like to copy, providing we found it within the range of possibility, which is rare indeed.

The new tube transmitter of NAA can be heard with no great difficulty as far east as the English Channel and as far west as San Francisco and south beyond Panama, but hearing and copying are two different things. In a recent voyage from London to San Pedro, via the Panama Canal, I found it possible to actually copy all of his press only upon three nights and this was done while northeast of Porto Rico. Static was rather bad on this trip, but if the station was of any consequence static would not have interfered. NBA is probably one of the best stations to copy, and his note is always clear and loud, piercing through the


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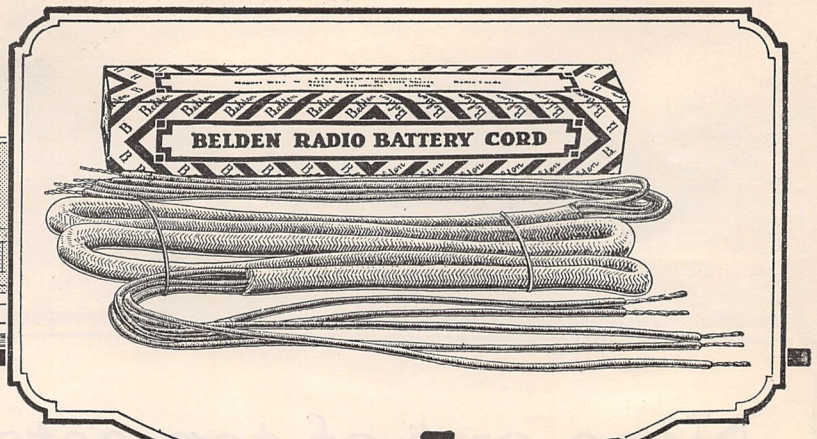
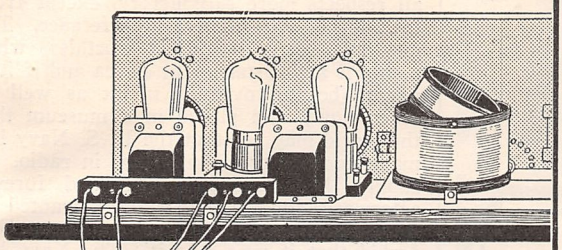
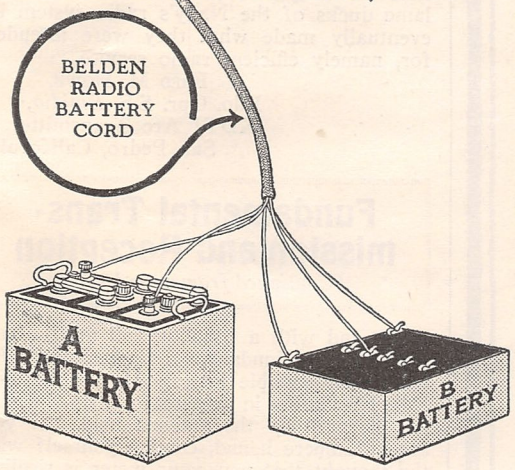


# No more crossed wires to burn out your tubes

### *Color Code*

***Every conductor is marked distinctly in color to identify each battery circuit.***




ONE accidental short-circuit between your A-battery and B-battery wires may burn out every tube in your set. It is folly to spend hours making carefully-soldered connections within the set, and then do a hasty, makeshift job of wiring from the set to the batteries.

The Belden Radio Battery Cord eliminates the danger of short-circuits between wires and insures a neat, compact job of battery wiring that improves the appearance of every set. The five flexible conductors (equivalent to two No. 16 and three No. 18 wires) are rubber-covered and then individually protected with a glazed braid. The five conductors are then enclosed in a glazed brown braid that resists wear and protects the conductors.

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Our instructive booklet, "Helpful Hints for Radio Fans," describes many other Belden Radio Products, such as Enameled Aerial Wire, Loop and Litz Wires, New Terminals, Magnet Wire on Small Spools, and many other items. Send for the booklet, right now!

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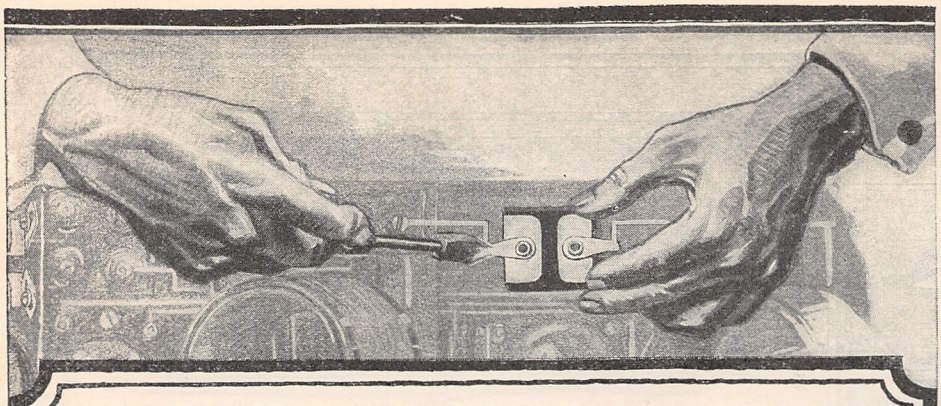

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*They know* that Micadons can be obtained in accurately matched capacities and the capacity is permanent.

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*They know* that Micadons are made with type variations to meet every possible requirement.

*For best results use Micadons*

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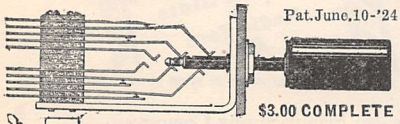


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heaviest static. NPL is just about as good; but NAA and NSS are the two "goat getters" of radio-land, insofar as it affects a wireless operator at sea.

My experience with NAA demonstrates to my own satisfaction that the old spark could be copied much further and was in all respects more satisfactory, except from the point of view of local interference. The new tube set is practically worthless when a ship is any distance out at sea and if it is not to be improved, it might as well be taken down and placed in a museum that the world may see that the U. S. Navy has made another brilliant failure in radio. It should then dismantle NSS and forever afterward forget that it once wanted to have a monopoly of all radio business. God forbid that it ever gets it. The Navy has many good operators, but it seems they are seldom permitted to work. Perhaps I should not complain, because I, too am only a "Ham", but I have a point in my favor, I do not disturb the ether more than once each day and then for only a seven word message. NBD is another station which should be forgotten. He is expected to work ships equipped with C.W., but one has to be so near him that he can see the whites of the operator's eyes before he can raise him. I often wonder if he is using a crystal detector to copy C.W. Most any ship can hear me further than he.

With all due respect to the United States Navy and its many great and glorious deeds and its fine personnel, I think a little constructive criticism from those who have suffered by its failures will or should act as a tonic and spur it to action, that the many sad defects in its radio chain may be mended. May NAA, NSS and all the other lame ducks of the Navy's radio system be eventually made what they were intended for, namely efficient radio service.

FRED M. HOWE,
Rdo. Opr. S.S. *Emidio*,
KDTJ Arc Transmitter,
San Pedro, California.

## Fundamental Transmission and Reception

(*Continued from page* 1421)

upon; and with a coupling coil at the base you have true fundamental transmission with the lowest possible losses. Do not be misled by radiation in amperes; rather consider the strength of the antenna field. If you are an ampere hound, content yourself with the thought that now your meter is reading in the hundreds (and forget that it is in milliamperes instead of amperes). Using 100 watts on each side of the cycle, at 90 meters, a current of 560 milliamperes was induced in the antenna. The efficiency of this method remains constant over all frequencies, and takes the guess work out of the designing of antenna for a given frequency.

In figuring the approximation of receiving current ordinarily between two similar stations over salt water, the Eccles formula given as follows, is fairly accurate:

$C = (6\pi^2 Ahx10^{10})/(\lambda xR)$

C = Received current
A = Current in transmitting antenna (amps)
h = Height from lead-in to top of antenna (meters)
$\lambda$ = Wave-length (meters)
x = Distance between stations (meters)
R = Resistance receiving antenna (ohms)

Between a transmitter employing true fundamental transmission and a receiving station employing this type of antenna, the following formula is more apt to hold good.

$$C = \frac{(283Ak^2)}{(\lambda xR)}$$

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## *Here's Why It Will Bring In Those Distant Stations Clearer Than Ever*

BY scientific tests, Goodrich Rubber Radio Products show the lowest dielectric losses of any practical radio insulating materials. This quality alone means that they give the greatest efficiency in radio frequency amplification. The set built of Goodrich products will give maximum range and selectivity for its type.

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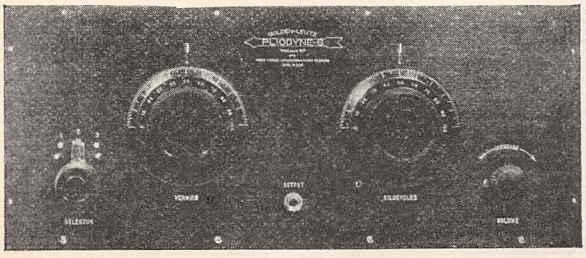
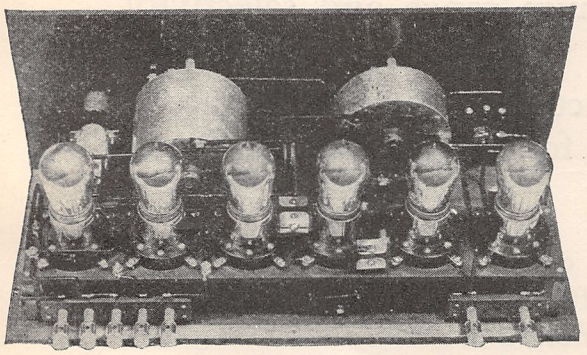


PLIODYNE 6
Front View Showing Simplicity of Control



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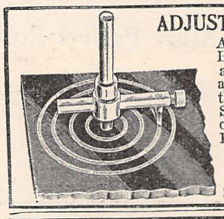

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Using an input of 200 watts, at an efficiency of 40 per cent., it was possible to maintain communication over a distance of 600 miles, day and night, for a period of three months during the summer and fall of last year, 1924. During that period reports from England, France and the west coast were received.

The advantages of this method are many: Your antenna is working at its highest efficiency. Swinging of the antenna does not cause fading. The problem of ground or counterpoise is eliminated, and the resistance of either or both is not added to the radiating system. While it has not been definitely ascertained, it is believed that signals from this method are very efficient during daylight. Certain experiments by Reinartz and the research laboratory at Bellevue resulted in a statement that 50 meters was a more efficient daylight wave. So far as known, all waves from this system are equally successful during the day.

Reception over a narrow frequency band permits the use of a fundamental antenna with aperiodic coupling. This especially applies to wave-lengths below 100 meters. The 75 to 85 meter band can be nicely covered without loss. The elimination of the receiving ground permits reception through static and ground current storms.

## The Inventions of Reginald A. Fessenden

(*Continued from page* 1389)

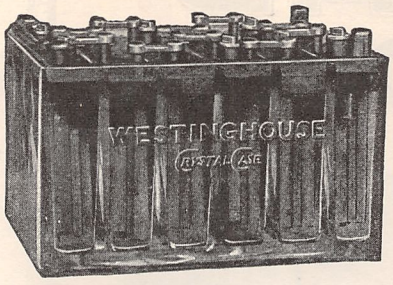
Theophrastus says that Anacharsis, the Scythian, invented the bellows and the double fluked anchor. But there seems to have been another Anacharsis who was a Hyperborean. And the Scythians were a very composite race. But the Mongols appear to have been inventors, e. g. though they did not invent printing (they had no alphabet and besides "logotype" dies were used in the Assyrian libraries long before the Chinese date), the compass was used to guide the Mongol carts many centuries before it was put to use on the sea by westerners. And the Telchines (Balachani) and Surachani whose names survive on the peninsula of Baku and the former of whom were well known to the ancients, may have been the connecting link between the Chinese and the Aegean. There was a great civilization, as old as that of Babylon, on the eastern shore of the Ocean of Selentchuk, (now dried up), near the present Balkasch and Dschalantschash Seas.

This is sufficient data for our present purpose. It seems that some races do not invent and others do. Heredity, then, is a factor.

Can we apply this in any way to the individual?

Mendel was an Austro-Silesian monk of wide activities, amongst other things a banker. He experimented on various plants and on bees. His first paper, giving his results on peas, and his laws, was published about 1860, but attracted little attention until 1900. From tabulation of a considerable number of cases I have found that it takes almost exactly 20 years, on the average, before the value of a great discovery begins to be recognized; possibly because 20 years is about one generation, the generation in which the truth originated apparently never receiving it. In Mendel's case it took two generations, possibly because it was overshadowed by the work of another great original worker, Darwin.

To state Mendel's laws with scientific precision would take too much time and necessitate too many qualifications. They will be found in the books of Punnett and other workers. Broadly, the main law is

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## *RADIO*

## *"A," "B" and "C"*

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that heredity is a matter of mathematical probability.

Take two boxes, containing an equal number of pairs of pieces of glass, but in one box pairs of spheres, in the other pairs of cubes. These two boxes will represent two individuals of a species. Take one piece of glass out of each box. The two will have a number of characters common to both, i. e. transparency, inertia, hardness, smoothness, etc. But one will roll on a smooth surface, the other will not.

Fasten the two pieces together to form what we might call a first descendant. The composite piece of glass will not roll. So we call the character of non-rolling a "dominant" characteristic and the quality of rolling a "recessive" characteristic. Make up three more of these pairs of pieces from the boxes, so that we have four first descendant individuals in all.

Pair these. We have then two pairs. Use these to form second descendants, using one piece from each individual of a first descendant pair, and fastening the two pieces together. Since each individual of a first descendant pair consists of one sphere and one cube, there are four kinds of second descendant pairs possible.

1. Cube and cube.
2. Cube and sphere.
3. Sphere and cube.
4. Sphere and sphere.

No. 1 resembles the original "grandfather", No. 4, the original "grandmother", and Nos. 2 and 3 the "parents."

Mendel discovered that this law of probability applied to heredity. If he took two kinds of peas, one tall, the other short, the first descendants were all tall, tallness being a "dominant" characteristic and shortness "recessive." If he then mated these, 75 per cent of the second descendants were tall and only 25 per cent short.

### APPLICATION OF MENDEL'S LAWS

These laws have explained many curious facts, e. g. why blue Andalusian fowls never breed true, but can always be obtained 100 per cent by mating a black and a black-splashed white Andalusian. They have also resulted in the development of new wheats, etc., giving crops worth hundreds of millions of dollars more than those obtained from the old kinds. It is a fascinating and very important field, and a good opening for young men as large returns may be obtained from it.

### APPLICATION TO HUMAN CHARACTERISTICS

Applying the laws to people is obviously much more difficult and uncertain. In the first place we do not know whether a supposed characteristic, e. g. inventive ability, is a real characteristic or due to circumstances. Again, the pairs which form the second descendants do not come, so to speak, all out of the same pair of original boxes, but out of two pairs of boxes.

### INVENTIVE FAMILIES

One reason why the son of an inventor may not give evidence of inventive ability is that, contrary to general belief, the inventor has as a rule, and as might perhaps be expected, exceptional business ability, provided he can be induced to exercise it. Stephenson, Edison, Ford, Weston, are examples. One of the most remarkable financial feats known is Edison's putting the phonograph back on a sound business basis after it had been run into the ground by professional business men. So if the inventor *does* decide to pay attention to business, the son may lack incentive or be swamped by administrative details. And if he does not, the son may decide that it is a mighty poor profession to take up.

Still, we have notable inventive families. The two Stephensons the Stevensons; (Robert Louis's "strenuous family"—

# 3 Tubes DO THE WORK OF 6

**Crosley Trirdyn Special, $75.00**
With tubes and Crosley Phones $90.75

# *In the* CROSLEY *Trirdyn*

SINCE the inception of radio, the results obtained with Armstrong Regenerative Receivers have been the goal of comparison for all others. Trick circuits have been designed to get around the Armstrong Patent hoping to obtain results "just as good." This has resulted in the use of more tubes, necessary without, but unnecessary with regeneration.

This is one reason why Crosley Radios, licensed under Armstrong U. S. Patent No. 1,113,149 have performed everywhere so remarkably on so few tubes.

The Crosley Trirdyn, employing Armstrong Regeneration combined with tuned non-oscillating radio frequency amplification and reflexed audio frequency amplification and using only three tubes, consistently gives greater selectivity, more volume and wider range than can be obtained where five or six tubes are employed without regeneration. With no regeneration, two stages of radio frequency amplification, requiring at least two additional tubes, must be employed in front of the detector tube to get the same results as furnished by one tube where regeneration is used.

Every additional tube means additional expense; an added dial to tune, greater difficulty in operation, more distortion and more tube noises. The three tube Crosley Trirdyn has only two dials. These operate but two circuits, making tuning and logging very easy.

You can't beat the results obtained from an Armstrong Regenerative Crosley Radio. A trial will convince you.

BEFORE YOU BUY—COMPARE
YOUR CHOICE WILL BE A CROSLEY

**For Sale By Good Dealers Everywhere**

*Crosley Regenerative Receivers are licensed under Armstrong U. S. Patent* 1,113,149

Prices West of Rockies—Add 10%

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## THE CROSLEY RADIO CORPORATION

Powel Crosley, Jr., President

222 Sassafras St. Cincinnati, Ohio

*Crosley Owns and Operates Broadcasting Station WLW*

**Crosley One Tube**
**Model 50, $14.50**
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**CROSLEY**
**Better-Costs Less**
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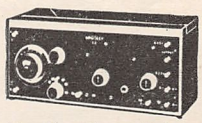
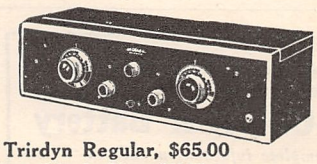
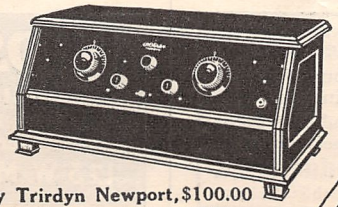


**Crosley Three Tube**
**Model 52, $30.00**
With tubes and Crosley Phones $45.75



**Crosley Trirdyn Regular, $65.00**
With tubes and Crosley Phones $80.75



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# MAGNAVOX Radio

## Receiving Set TRF-5 with Reproducer M4 - $125.00

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EXPERIENCED radio users have stated that this Magnavox equipment (illustrated below) represents the highest standard of real value and usefulness ever offered in the radio field.

The Magnavox 5-tube circuit is a special development of tuned radio frequency in which a splendid balance of selectivity, range and volume have been attained. The one dial Station Selector eliminates all tuning adjustments; while the Magnavox Reproducer insures sonorous, pleasing tone for all programs.

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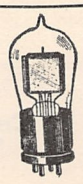

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Bonded to Give Service.
List Price ..... $4.00
Send in your old and burnt out tubes
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Embodying a marvelous New Non-Oscillating Principle
Sold Direct on Free Trial and Easy Terms
*Write for catalog and Special Offer*
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**HUDSON-ROSS**
Sells only nationally advertised radio apparatus.
Send for discounts.
123 W. Madison St. Chicago


"Say not of me that weakly I declined
The labours of my sires and fled the sea,
The towers we founded and the lamps we lit,
To play at home with paper like a child.
But rather say:—*In the afternoon of time
A strenuous family dusted from its hands
The sands of granite, and beholding—*").

The Maxims (Hiram, Hudson and Percy, another Yankee family); the Parsons, etc. This last ran to three generations. Lord Rosse made many inventions relating to telescopes and astronomical work. Sir Charles Parsons invented the steam turbine and other important devices. His son, a young man of remarkable ability, had made a number of inventions and would have made many more without doubt, but that he was killed in the war. Parson's son, Kipling's son, Osler's son—as I think over the long list I am not sure but that the greatest evil of the war is that to come; the loss to the time which should have been theirs of the work these brilliant young men should have done.

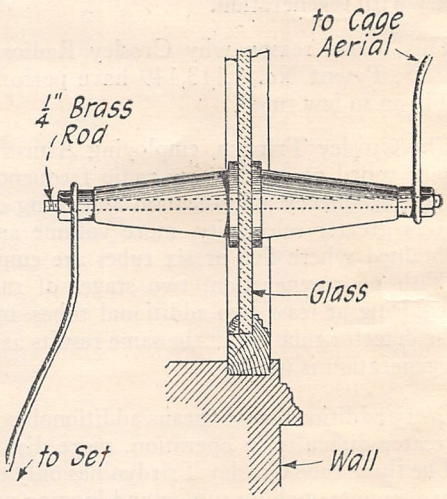
It should be possible to obtain full data of the families I have mentioned. It would be a good thing if the Eugenic or some similar society took it in hand. In my own case I do not care to go into it; it would mean too much detail. It will be sufficient if the main points are given, so that those interested in Mendelian work will know where to obtain the details.

(*To be continued*)

## Radio Wrinkles

(*Continued from page* 1426)

the center of a glass plate 12x12¼ inches, drill a hole to take a rod ¼ inch in diameter. Also drill the same size hole in the bottom of two jelly glasses. A drill may be made from an old three cornered file, ground down to suit. Rubber washers are cut to fit the tops and bottoms of the glasses. Now procure a brass rod equal in




Home-made aerial insulator.

length to the glasses and the thickness of the glass plate plus allowance for the necessary nuts and washers. The brass rod is placed through the plate glass and the jelly glasses, as illustrated in the drawing. This insulator will be found to be efficient and complies with the fire underwriters' code.

—*Contributed by L. C. Miller.*

### BUREAU OF LIGHTHOUSES GENERAL CALL

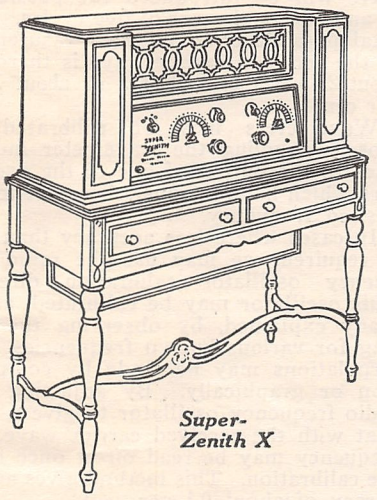
Call letters WWLH have been assigned as a general call signal for all radio stations of the Bureau of Lighthouses. This signal is to be used only when all radio stations of the Bureau of Lighthouses or a group of these stations are called. When only one station is to be communicated with, the call letters of that station must be used.

# ZENITH RADIO

TRADE MARK REG.

***Super-Zenith VII—the ideal radio set for the fine home***

***They Cost More But They Do More***



***Super-Zenith X***

## Fulfills your utmost desire, in beauty and performance

The new Super-Zenith is beautiful to look at—lends an atmosphere of dignity and worth to library or drawing room.

Naturally you expect unusual performance from so beautiful a radio set. And—unusual performance is exactly what you ***get.***

Tuning, for example, is controlled by ***two dials only***—so perfectly adjusted that each station comes in always at the same dial settings. ***It never varies.*** Powerful locals may be on full blast, yet you can tune them out completely and bring in distant stations. Tone reproduction is always clear and true; the volume always adequate.

Before you make your choice, be sure to see and try the new Super-Zenith. A fifteen-minute test will give you a new standard of radio values, as applied to beauty of construction—and—***performance.***

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## ZENITH RADIO CORPORATION

332 South Michigan Avenue, Chicago

ZENITH—the exclusive choice of MacMillan for his North Pole Expedition
Holder of the Berengaria Record

THE complete Zenith line includes seven models, ranging in price from $95 to $550.

With either Zenith 3R or Zenith 4R, satisfactory reception over distances of 2,000 to 3,000 miles is readily accomplished, ***using any ordinary loud speaker.*** Models 3R and 4R licensed under Armstrong U.S.Pat.No.1,113,149.

The new Super-Zenith is a six-tube set with a new, unique, and really different patented circuit, controlled exclusively by the Zenith Radio Corporation. It is NOT regenerative.

SUPER-ZENITH VII—Six tubes—2 stages tuned frequency amplification—detector and 3 stages audio frequency amplification. Installed in a beautifully finished cabinet of solid mahogany—44⅞ inches long, 16¾ inches wide, 10⅝ inches high. Compartments at either end for dry batteries. Price (exclusive of tubes and batteries) . . . . $230

SUPER-ZENITH VIII—Same as VII except—console type. Price (exclusive of tubes and batteries) . . . . . $250

SUPER-ZENITH IX—Console model with additional compartments containing built-in Zenith loud speaker and generous storage battery space. Price (exclusive of tubes and batteries) . . $350

SUPER-ZENITH X—Contains two new features superseding all receivers. 1st—Built in, patented, Super-Zenith Duo-Loud Speakers (harmonically synchronized ***twin*** speakers and horns), designed to reproduce both high and low pitch tones otherwise impossible with single-unit speakers. 2nd—Zenith Battery Eliminator, distinctly a Zenith achievement. Requires no A or B batteries
Price (exclusive of tubes) . . . . . $550
Price (without battery eliminator) . . . . $450
All Prices F. O. B. Factory.

Zenith Radio Corporation
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Gentlemen: Please send me illustrated literature giving full details of the Super-Zenith.

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# Oh boy!

Here's the new

# RICHARDSON 5

*A New Invention*

The only set that neutralises equally on all wave-lengths with no losses.

This 5-tube wonder in a beautiful cabinet costs only

**$65**

Compare it with any other set at any price.

Same set in Kit form, with no cabinet or accessories

**$49**

RICHARDSON RADIO INC.

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**Perpetual Radio Fuse $2.50**
$100.00 reward if you can blow your tubes with this protector in your circuit according to our instructions.
SUPER ULTRADYNE Transformers, complete set including blue print ..... $16.00
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DEALERS and JOBBERS we have an attractive territory proposition.
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## How Earth's Rotation Sets Radio Frequencies

(*Continued from page* 1406)

by the radio receiver has, therefore, a frequency corresponding to the difference between the frequencies of the incoming wave and of the wave generated by the radio oscillator. This difference of frequency can be measured with very high precision by comparison with a calibrated low frequency oscillator, the adjustment of this latter oscillator being made to give a zero beat in the loud speaker.

This difference, added to or subtracted from the known frequency, gives the frequency of the incoming carrier. The sign of the correction is determined by observing the direction in which the frequency of the radio oscillator must be changed in order to reduce the frequency of the heterodyne note.

Let us now examine the precision with which an incoming radio frequency, of approximately 1,000 kilocycles, may be measured. The absolute value of the frequency of the base is known to better than one part in 100,000. The oscillator B may be held to 100 times this frequency to well within 1 cycle. The product is, therefore, good to two parts in 100,000. Similarly, the oscillator C may be held to within one cycle of 10 times the frequency of oscillator B. Assuming that all these errors have been made in the worst possible manner, the maximum error in the setting of our million cycle oscillator is 21 cycles. The calibration of the low frequency oscillator is good to much better than one part in 1,000. If, therefore, the difference between the frequency of the received carrier wave and that of our radio frequency oscillator is in the neighborhood of 5,000 cycles there will be introduced the possibility of an additional error of five cycles. The total possible error in the measurement of the received carrier wave is therefore about 25 parts in 1,000,000, or about .0025 per cent.

Wavemeters may be calibrated by loosely coupling the wavemeter inductance to the output of one of the oscillators which has previously been set to the desired frequency.

In cases where less accuracy than this is required, we may use the radio frequency oscillator calibration directly. This oscillator may be calibrated, as already explained, by observing the setting for various known frequencies. Interpolations may be made by computation or graphically. By adjusting this radio frequency oscillator to give a zero beat with the received carrier wave, the frequency may be read off at once from the calibration. This method gives an accuracy of about 0.1 per cent.

## The Photoradiogram System

(*Continued from page* 1385)

light waves into electrical impulses or waves, which can be transmitted by radio much the same as a regular dash and dot message.

### THE "EYE" OF THE TRANSMITTER

This photo-electric cell is commonly spoken of in the laboratory as the "eye" of the transmitter. The electrical resistance of this cell changes in accordance with the amount of light which falls upon it, and in this way takes care of the shading of the picture in transmission.

The photo-electric cell functions practically without any lost motion. That is, the

LET the others have their card games—Grandpa settles down to real amusement—at the radio.

His dependable Brandes Headset shuts out the babble. Its *Matched Tone* gives him each word clearly—with identical tone and equal volume for both ears.

Grandpa's in a world of his own—and the game continues undisturbed. Everybody's happy!

*Table-Talker* $10.00. [50 cents additional west of the Rockies.] In Canada $12.50.

Superior *Matched Tone* Headset . . . . . $6.00. In Canada $7.00.

# Brandes

## *The name to know in Radio*

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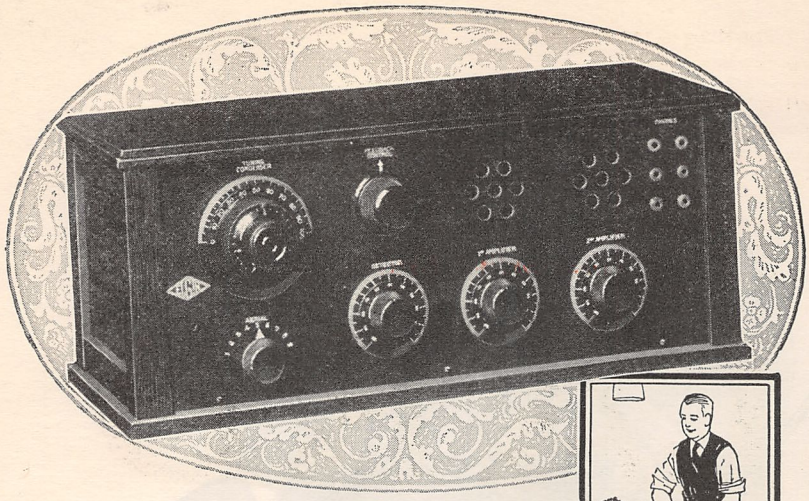


# Build this set *without* Soldering~ Save Fifty Dollars!

Elgin Super-Reinartz — The FORD of RADIO

BUILD an exact model of the famous set that heard London. We furnish you the duplicate parts and improved diagram of the Elgin Super Reinartz set that twice listened to Station 2LO last season. You can build the complete set in less than an hour and——

*You Can't Go Wrong*

Every part is plainly shown on the diagram, every part is properly marked and drilled, the panel is beautifully engraved and the cabinet grooved and drilled. The set assembles as easy as building blocks and *there is nothing to solder.*

*Amazing Reception*

Hundreds of letters weekly attest the superiority of the Elgin Super-Reinartz. Thousands of satisfied Elgin Set owners are enjoying reception that outdistances all ordinary sets. Join this army of happy fans—have the fun of building your set—save the big difference between the parts and cost of factory construction—and get stations you have never touched before.

*Send Stamp TODAY for Details!*

## What Others Say

"You are entirely too modest in your claims. . . . I get Pacific Coast on loud speaker regularly. . . ." —Clare Hopps, Royal Oak, Mich.

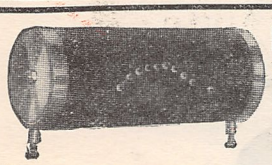
"You have a winner. . . . Had no idea it could be so easy to assemble. . . ."—N. J. Sullivan, Holyoke, Mass.

"Logged 32 stations last evening — from Springfield, Mass., to Oakland, Cal.—all on Loud Speaker!"—O. C. Harr, Aurora, Ill.

"Best on the market today. . . . Your service interesting and helpful. . . ." —Geo. D. Duyer, Louisville, Ky.

**Elgin Radio Supply Company**
**Suite C, 209 E. Chicago St., Elgin, Illinois**

# ELGIN Super-Reinartz



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*Not new, but proven the best of "'em" all. Ask any user.* **"All Wave Tuner"**

**NEW YORK to FRISCO clear as a bell**

The only one control tuner, 200 to 600 meters, complete with hook-ups mailed anywhere. **$1.50**

Write us today for our Big Monthly Wholesale Radio Catalog which quotes you "direct-to-consumer" prices and is mailed to you monthly.

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**Use RESISTANCE!**

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Grid Leaks

*Variable:—*
No. 101—1-10 to 5 megs.—soft tubes.
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*Metalized Fixed:—*
Over ¼ meg., 50c; under, 75c.

**75¢** *at dealers or postpaid*

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instant the slightest change in the amount of light reaches the cell, a corresponding change in the output current of the cell takes place. In this way the "eye" of the transmitter is able to "see" even the tiniest light variations; in fact, the "eye" sees and records electrically millions of different current impulses as the film sweeps by the light beam from inside the cylinder.

### FROM LIGHT TO ELECTRIC CURRENT

The photo-electric cell is, therefore, responsible for reproducing an infinite number of different electric current values which correspond with the light or dark areas of the picture being transmitted.

In order to cover all of the original film, the glass cylinder is rotated back and forth and in this way the entire surface is eventually exposed to the piercing light beam. The film rotates through an angle equal to the width of the picture and the electric camera itself advances down the length of the picture one notch at a time. Thus, line upon line, the whole picture is covered.

### FROM ELECTRIC WAVES TO RADIO WAVES

After the signal impulses or electric waves from the photo-electric cell pass through a series of vacuum tube amplifiers, they are fed into a modulating device ready for transmission. The electrical interpretation of the picture is then transmitted over land wires from the London laboratory to the Carnavon, Wales, high power transmitting station of the Marconi Wireless Telegraph Company, Ltd. Here the electric impulses on the land wire operate small relays which turn on and off the high value currents flowing from the 200 kilowatt generator to the antenna system. This high power electrical energy leaving the antenna in interrupted impulses, similar to dots and dashes of the telegraph code, creates the ether waves which carry the photograph through space 3,000 miles to the receiving station on this side of the Atlantic, located at Riverhead, L. I.

The development of the photoradiogram transmitter has purposely been carried on in connection with the established radio transmitting stations, now engaged in sending radiograms daily between Europe and America. Thus the new device does not require the preparation of any special radio circuits for efficient operation.

### THE RECEIVING STATION

At Riverhead, L. I., in the Radio Corporation's central receiving station, the operator tunes in to the Carnavon station. He receives the picture just the same as he would a radiogram, but instead of dots and dashes which he can read he receives an undecipherable series of impulses. These pass through a bank of vacuum tube amplifiers and are then sent by land wire to the laboratory of the Radio Corporation located in the building in Broad Street.

Here this unintelligible code, carrying the photograph, is translated back into black and white, recording the original picture much in the style of a stippled engraving.

### THE UNSCRAMBLER

This device in the R.C.A. Laboratory (the final operation involved between transmitter and receiver) decodes or unscrambles the complex photo message, giving each individual electrical pulse of energy a definite task to perform in reassembling the picture.

The picture is reproduced in duplicate at the receiver, both on a paper record and on a photographic film. The paper upon which the record is made is wrapped about a rotating cylinder, which, in size and appearance, much resembles the early type wax phonograph record. A specially constructed fountain pen bears against this just as the needle of the phonograph does on a record. The pen is attached to an electrically controlled lever in such a way that every pulse of

**WHEN** "The King of the Ivories"* is tickling the keys at WOS.

**WHEN** WOR comes rolling in from the East and KFI, in its time and turn brings greetings from the Pacific coast.

**WHEN** your Saturday evening dance from WTAM is making just the biggest kind of a hit—*remember that*

# WILLARD RADIO BATTERIES

are contributing to your enjoyment, for at these and *at 175 other leading Broadcast Stations* Willard Batteries are used to furnish the steady current that is required for perfect amplification of voice and music.

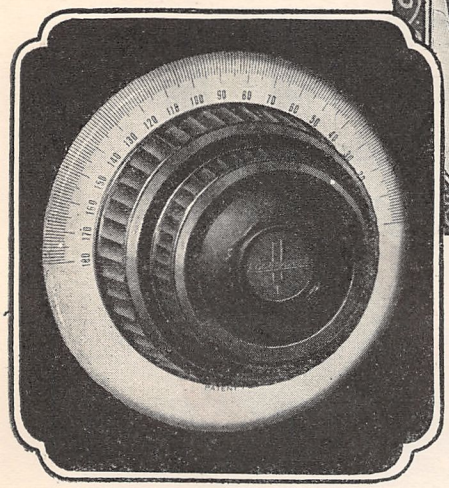
## *Write to* WTAM *for this booklet—*

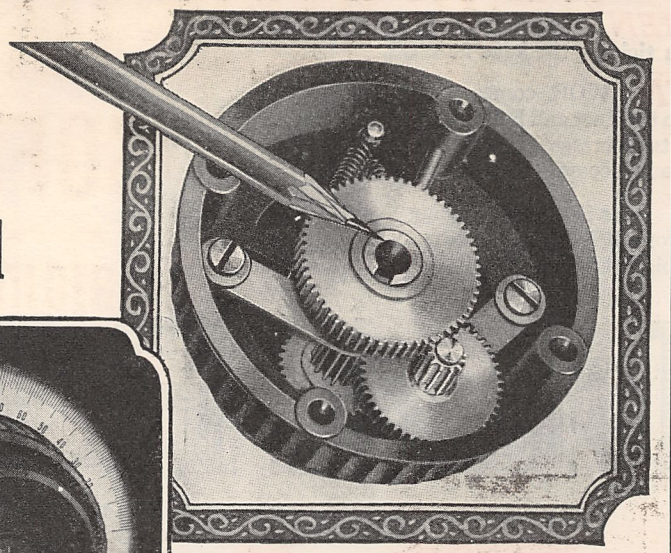
*(The Voice of the Storage Battery)*

Every owner of a receiving set should have these booklets. They tell how to get greater distance, more volume and better tone quality; and they show why Willard Batteries are the most economical and most satisfactory form of power you can use.

**WTAM** is the Radio Research Laboratory and Broadcast Station of the Willard Storage Battery Company, Cleveland, Ohio. The wave length is 361 meters—on the air for your enjoyment every Monday, Wednesday and Saturday evening.

# All Wobble Eliminated





## By Long Center Bushing

Look at that long center bushing! Watch the new model Accuratune when you tune in—how smooth it operates—how precise its movement without the slightest indication of wobble.

Few vernier dials, built as they must be to take all standard condenser shafts, are designed as the Accuratune to positively eliminate this universal objection—dial wobble.

And just this one point of refinement characterizes the complete makeup of the Accuratune Micrometer Control—features that assure most unusual tuning efficiency.

Micrometer Controls easily replace ordinary dials without any set alterations. Just tighten the set screw on the large knob.

At your dealer's, otherwise send purchase price and you will be supplied postpaid. Price $3.50.

New Accuratune Features

Geared 80-1 ratio
No back lash
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electrical current, which passes through the magnet coils of the relay lever draws the pen to the surface of the paper, making a fine ink mark. A changing current fed through the magnet coils causes the pen to wiggle in step with the current impulses, thus giving the artistic stippling effect in the reproduced picture.

### ABSOLUTE SYNCHRONISM NECESSARY

One of the outstanding requirements in sending pictures by radio or wire is absolute synchronism of the sending apparatus with the receiving device, otherwise distortion will occur. If the receiving apparatus should lag the slightest particle of time behind the transmitting set, the received picture would be blurred and unrecognizable.

The necessary synchronism is maintained by the use of special driving motors, one geared to the transmitting cylinder and the other geared to the receiving cylinder. These motors, although separated by 3,000 miles, maintain the same speed. To check against any change which might occur, special controlling mechanism is attached to the receiver, based upon the constant pitch of the tuning fork.

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The making of the ink record is visible in all its operations. The wiggling of the fountain pen can be watched as the cylinder rotates back and forth, gradually building up the picture. The photographic record is made on an ordinary camera film inside a specially constructed camera, a beam of light playing upon the film in place of the pen upon the paper. This is developed as any film and as many prints can be made from it as desired.

## Charts for the Determination of Inductance and Wave-length

(*Continued from page* 1431)

that will oscillate at 400 meters. The capacity needed is approximately 97 micromicrofarads.

If we wished to have a circuit oscillating at 300 meters using a .0005 mf. condenser, how much inductance would be necessary? The chart shows a value of 500 microhenries.

**2. Inductance chart.** To use this chart it will be convenient to prepare a piece of celluloid or tracing paper, about 6 inches square, by scratching or ruling upon it two diagonal lines which intersect at right angles. A ruler and a draftsman's triangle will also work admirably.

The calculation of the inductance of a single-layer coil involves the length of the winding, b, the diameter of the winding (center to center of the wire), d, (both in inches), the number of turns, n, and a factor K, which is a function of the shape of the coil. (See Circular of the Bureau of Standards, No. 74, "Radio Instruments and Measurements," page 252.)

The first operation is to find K. This is found from the network by entering at the proper value of the length, b, and following this line to the proper diameter (oblique line), d, thence proceeding along the horizontal line to the value for K.

Find this value of K on the other scale for K and the value of d on the scale labelled "Diameters." Through these two points pass one of the lines of the device prepared in such a way that the other line will pass through the proper point of the "Length" scale. This line will now cut the line labelled "Transfer." Now swing the device around this intersection as a pivot (done by placing the point of a pencil upon the intersection) until the line cuts the scale

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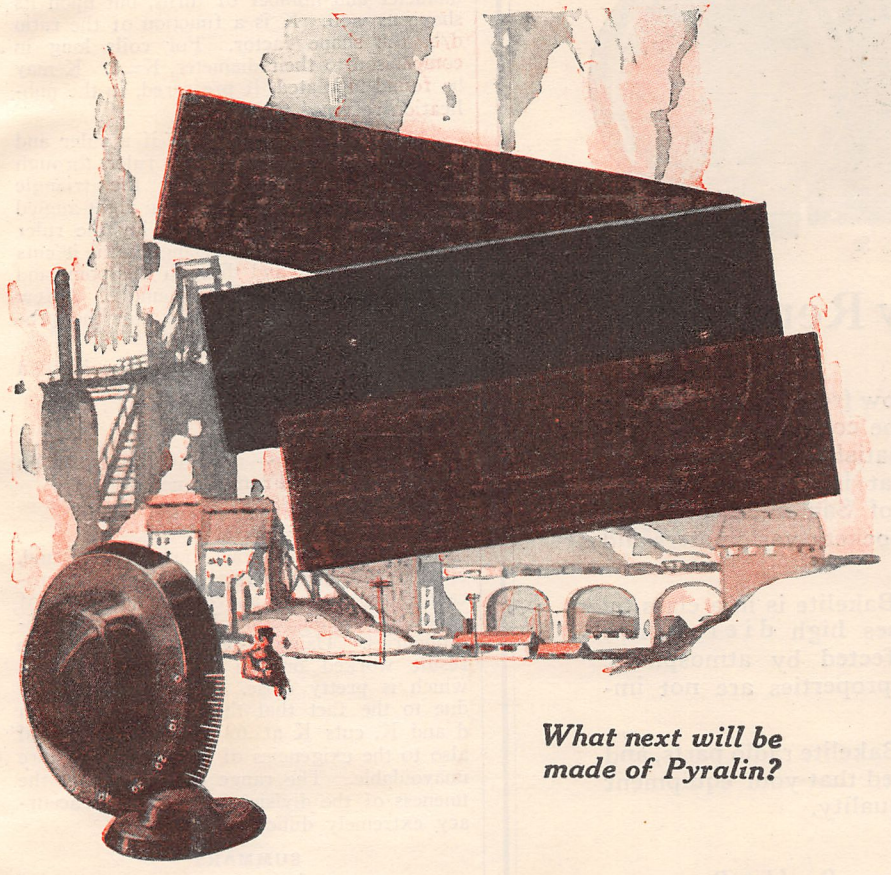

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| 7 x 12 | 1.97 | 2.36 |
| 7 x 14 | 2.30 | 2.76 |
| 7 x 18 | 2.95 | 3.54 |
| 7 x 21 | 3.45 | 4.14 |
| 7 x 24 | 3.94 | 4.73 |
| 7 x 26 | 4.25 | 5.10 |

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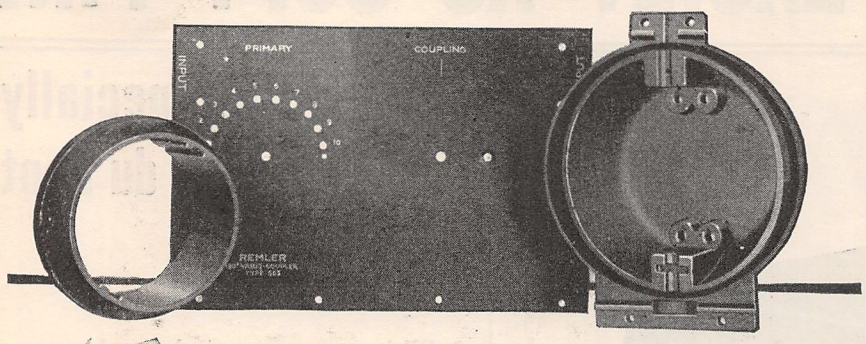


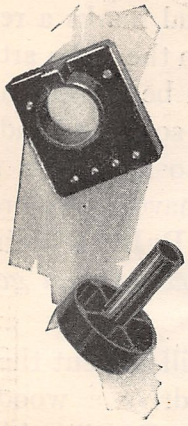

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labelled "Number of Turns" at the correct value. This line will then cut the Inductance scale at the correct answer. This procedure is illustrated graphically on the chart.

It should be emphasized that the network is used only to find K, and not thereafter. The fact that the transfer line happens to coincide with one of the lines in the network has no significance, and this was done to economize space. The reason for the necessity for K is because the inductance of a coil is dependent not alone upon its length, diameter and number of turns, but upon its shape as well. K is a function of the ratio d/b, the shape factor. For coils long in comparison to their diameter, K=1. K may be found tabulated, if preferred, in the publication referred to above.

The procedure is the same if a ruler and triangle are used. Pass the ruler through the points K and d. Lay the triangle against the ruler so that its right-angled edge passes through b. Now lay the ruler against this edge of the triangle until it cuts the transfer line, and through this point and n, in a straight line, will be found L. A few trials will convince the user that the procedure is very simple.

**Example:** Let us suppose we have a coil in which

Diameter—d = 2½ inches
Length—b = 2½ inches
Number of turns—n = 100 turns, as on the chart. From the net
Ratio—K = .688.
Inductance—L = ?

The dotted line shows how K is found, and the three dotted lines illustrate the procedure as outlined above, in the order of procedure. The result, L = about 435 microhenries. Using 5-place logarithms, the result worked out to 431.2 microhenries, which is pretty close. The discrepancy is due to the fact that the first line, through d and K, cuts K at .69 instead of 688, and also to the exigencies of drafting which are unavoidable. The range embraced, and the fineness of the divisions, make closer accuracy extremely difficult.

### SUMMARY

Question might be raised about the advisability or necessity of including so many values of K on the network from which it is found, and furnishing so small a scale for its actual use. The answer is that for great precision the formula would have to be solved and it would be advisable to have K to three places as given. In the use of the chart, hundredths can be estimated nearly enough, and greater subdivision there would not have been consistent with that of the other scales. In the event of K being needed for calculation, it is true that it is much easier to obtain it from the network than from the tables, because the argument of the table is a ratio, d/b, which would have to be worked out before K could be found; and finding it from the chart is only one operation.

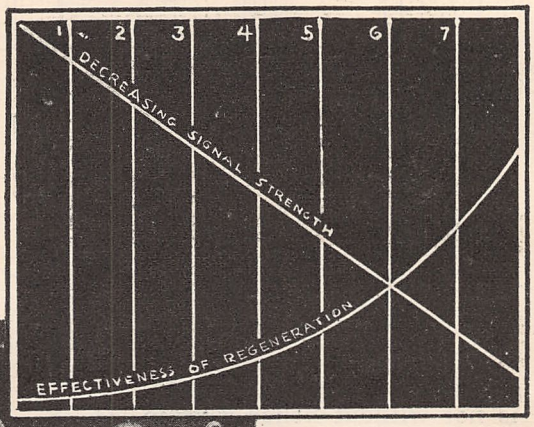
The increments of the b and d scales are eighths of an inch, in the belief that most coils are constructed to this unit. If, however, the coil is measurable with greater accuracy, it is easy to interpolate on the various scales with reasonable accuracy—probably greater than that of the measurement itself.

The same percentage accuracy is obtainable throughout the entire range on both diagrams.

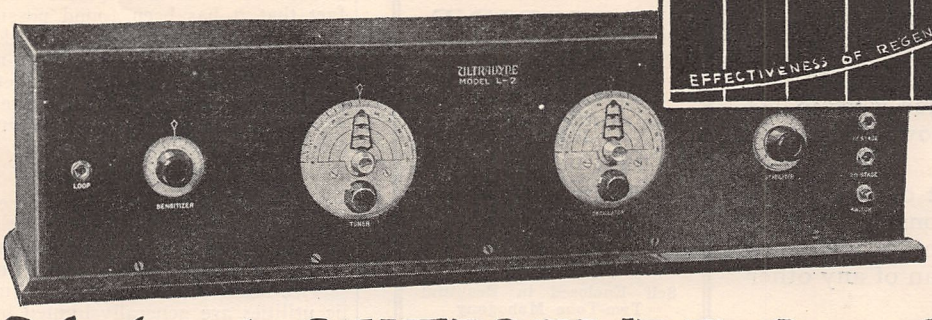
*Bibliography*:


*Hewes and Seward, "The Design of Diagrams for Engineering Formulas," McGraw-Hill.*

*Bureau of Standards, "Radio Instruments and Measurements," Circular No. 74, Government Printing Office.*




*Graph showing how the regenerative effect in the Model L-2 Ultradyne increases as the strength of the received signal decreases.*

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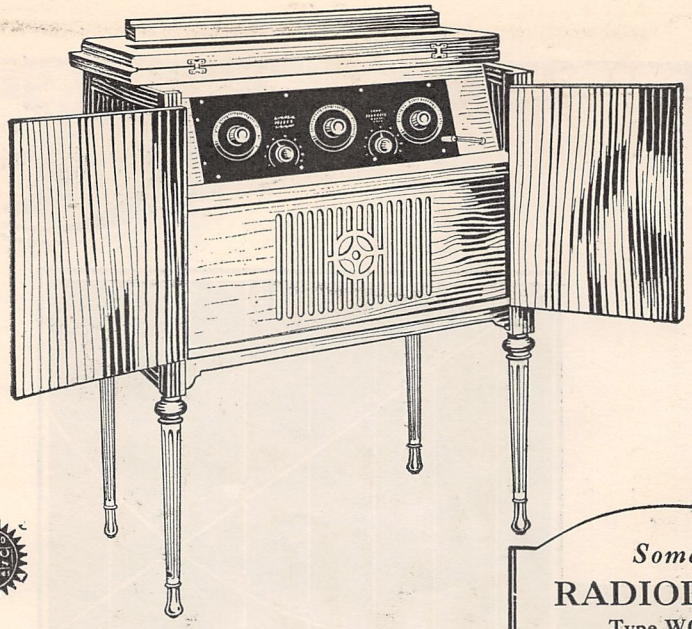

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## Hoover Wants No New Radio Laws

(*Continued from page* 1383)

first is the interconnection of stations by which a single voice may be broadcast from all parts of the Untied States. This interconnection has been most successfully carried out by the use of the wire systems between broadcast stations, but other methods of interconnection are in use and process of development. It is difficult to see as yet what the public implications of interconnection will be.

"During the past year there have been discoveries in the use of higher power, and therefore larger areas of broadcasting, which may result in a single station being able to cover a large portion, if not all, of the country. This raises questions of the rights of local stations and the rights of local listeners.

"Still another development has been the fact that it has been found possible by indirect advertising to turn broadcasting to highly profitable use. If this were misused we would be confronted with the fact that service more advantageous to the listeners would be crowded out for advertising purposes.

### LIMITATIONS

"Because of this situation there is growing up a demand for the limitation of the number of stations in a given area, and that such a limitation would be based on the service needs of the community, just as public utilities are generally limited by the rule of public convenience and necessity. Again this enters a dangerous field of recognizing monopoly and implied censorship.

"On the other hand, we may be in a rush to broadcast which may in time die down and the number of stations may decrease. Alternatively improvement in the art may increase the number of available wavelengths and no priorities need then be contemplated.

"These are not all of the shifts in progress, and we may have to come to the conclusion that many station owners must be considered as having abandoned the field of private enterprise and entered that of public service. In view of these changes, we may have to reconsider the regulation of the whole art from the point of view of the listener.

"The public interest of radio broadcast is rapidly widening. Entertainment and amusement have ceased to be its principal purposes. The public, especially our people on farms and in isolated communities are coming to rely on it for the information necessary to the conduct of their daily affairs. It is rapidly becoming a necessity, and they rightly feel that, since the public medium of the ether is used to reach them, they have a direct and justifiable interest in the manner in which it is conducted.

### CONGRESS TO HAVE POWER

"From all of this it seems to me that there is a tendency which may require an entirely different basis in character, theory and extent of legislation than we have contemplated in the past. The basis of regulation and the fundamental policies to be followed must be finally declared by Congress, not left to an administrative officer. Hitherto, we have conceived the problem to be one of interference, but there is now opening before us a whole vista of difficult problems. The development of the art is such that the whole situation is changing rapidly, and the opinion of today on the solution for a given difficulty is worthless tomorrow.

"I hope that another year's experience will show what direction of legislative course must be pursued. Meantime I feel that we

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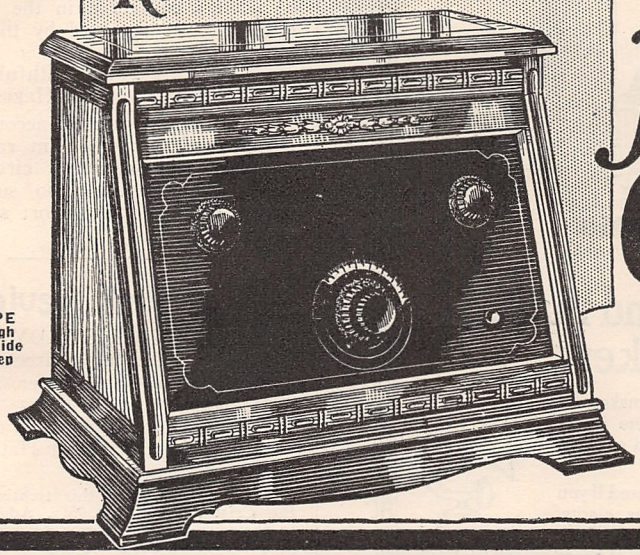


TABLE TYPE
16 Inches High
21½ Inches Wide
14 Inches Deep

# *Just* ONE *Dial To Tune*

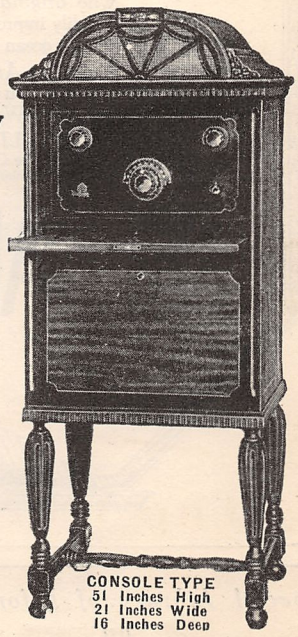
## Just *ONE* Dial to Turn to Get Coast to Coast Range
## Just *ONE* Dial to Adjust to Get Perfect Tone Reception
## Just *ONE* Dial to Tune to Get the Utmost in Selectivity

Years ahead, the sensational simplified Mohawk 5-Tube Receiver now contributes the most drastic and far-reaching improvement for the universal enjoyment of radio. Never before has loud speaker reception been so simplified and dependable that head phones are not required, and tuning skill is no longer necessary.

The new Mohawk creates new conceptions of what loud speaker radio can do. No more difficult tuning on complex multiple controls. Handle all your control on just ONE dial. Reach out from coast to coast. Cut through local stations at will. Bring in distance loud and clear on the loud speaker. Repeat your tunings on identical dial settings as often as you like. Children can do it—elderly people—anybody among your family and friends.

Five tubes have long been recognized as the most efficient, practical coast to coast power—and with the new Mohawk everything heretofore possible on any other 5-tube set is now achieved so much faster, easier and better on just ONE Dial (and at no greater cost). The knife-like sharpness of tuning and the resulting greater beauty of tone and loud speaker volume exceed anything you have ever heard.

Send the coupon below for the new facts. Compare the Mohawk on the basis that on just ONE Dial it will surpass the performance of any other set. The new Mohawk stands alone—truly the last word in radio. Send the coupon NOW.



CONSOLE TYPE
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would be actual gainers by allowing the industry to progress naturally and unhampered, except by the maintenance of a firm principle of Government control of the ether and the elimination of interference so far as it is possible.

"The suggestion which I inclose is necessary under whatever regulatory theory may develop. It merely affirms the authority now exercised by the department over wavelengths, power, apparatus and time of operation. It is in the nature of emergency legislation urgently needed to preserve the situation in the public interest, until a final and complete legislative policy can be adopted. It contains the provision reserving Federal control over the ether. Its other provisions are merely condensed statements of powers conferred in the bill which you introduced as reported by the House Committee.

"Yours faithfully,
"HERBERT HOOVER."

It is thought that on account of this expression of opinion from radio's foremost exponent in Government circles, no important legislation of radio subjects will be passed in the coming short session of Congress.

## Book Review

ZINCITE ET CRISTADYNE. By Michel Adam, Managing Director of "Radio-electricite." Paper cover, 5 x 7¼ inches. 45 pages. Illustrations and diagrams. Published by Bibliotheque de Radioelectricite, 98 bis, Boulvard Haussmann, Paris. Price 3 francs.

In his foreword to this treatise on zincite and the Cristodyne circuit, Mr. Adam writes that it is the third in the series of great eras in radio progress—first came the galena detector, then the vacuum tube, and we are now at the threshold of the zincite era.

The pamphlet is divided into four parts. In the first Mr. Adam very interestingly relates how the crystal is found and the processes it undergoes before being used in a set. The second part is devoted to the functioning of the crystal, its charactersitic curves and other properties. The different types of circuits that zincite may be used in are set forth in the third portion, with data for their operation. In the last chapter the author gives complete constructional and operating data for the Cristodyne set. This pamphlet is an excellent treatment of a most interesting subject.

THE U. S. NAVY'S RADIO MANUAL. (New and revised edition.) By Admiral S. S. Robison, revised by Commander S. C. Hooper. Published by the U. S. Naval Institute, of Annapolis, Md. Hard covers, octavo. $8.50 postpaid.

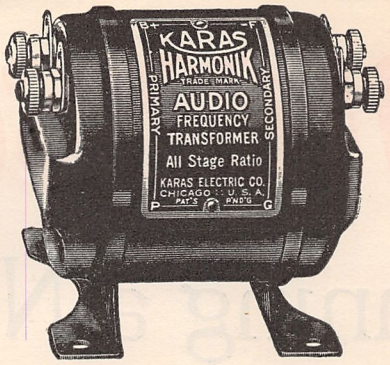
The sixth edition of "Robison's Manual of Radio Telegraphy and Telephony" has just been delivered from the press to the U. S. Naval Institute, Annapolis, Md. This Manual has, since 1907, been the authorized textbook spokesman of the Navy Department in radio matters, and although five editions have revised the work of Commander (now Admiral) S. S. Robison, the original author, the Manual still bears his name because of his always intense interest in radio matters and his great work in the betterment of Naval radio in the early days.

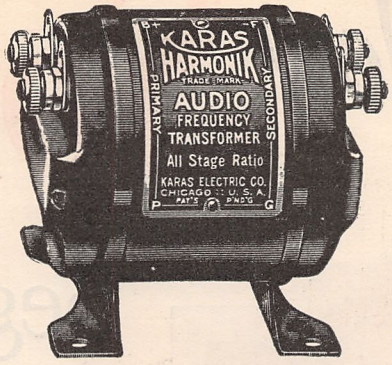
The Navy has been a constant user of radio since the first demonstration of its great value for ships in 1900, and up to the recent popularity of radio due to broadcasting was the principal incentive for and moving spirit in the development of radio.

The original purpose of the Manual was to furnish a textbook for Naval operators and other Navy personnel dealing in radio, but the book has always had a wide circulation because of the public appreciation of the Navy's unbiased position in radio matters.

Previous editions have been quite brief and more or less limited to types of apparatus of particular interest to the Navy. The present edition was undertaken subsequent to the commencement of broadcasting and pressure brought to bear on Commander S. C. Hooper, until recently the officer in charge of Naval radio matters and his staff of technicians, who revised the present edition, to make it of such character and scope as to be of value, not only to the more or less skilled personnel of the Navy, but to the public in all of its phases of interest and ability in radio matters.

(*Continued on page* 1470)

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# Marvelous Reception

## from these Scientifically Designed New Karas Harmonik Audio Frequency Amplifying Transformers

MUSIC that is absolutely true and natural. Clear, round, full mellow tones. Piano music that could never be mistaken for a harp or banjo. Speech so natural that you would instantly recognize the voice if you knew the speaker. Orchestral music poured out of the loud speaker with all the tones of each one of the instruments so accurately amplified that you feel as though you were sitting in the concert hall. This is what you hear when you listen to radio reception amplified through Karas Harmonik Transformers.

It is impossible to picture in words the new thrill you will experience on hearing the exquisite musical quality of reception delivered by this wonderful new transformer.

What a revolutionary change in transformer design must have been made to account for this amazing improvement in radio reception !

### An Engineering Triumph

Karas engineers, with the experience gained in building hundreds of thousands of audio transformers, worked more than a year and spent many thousands of dollars to achieve it. Distortion —that bugaboo of radio—is entirely eliminated. Low tones and very high tones are amplified equally with the middle tones. The vital harmonics and rich overtones — the qualities that distinguish music from noise — are brought out in their full beauty.

Important engineering problems had to be solved to accomplish this uniform amplification—and to deliver a high amplification factor absolutely free from the disagreeable distortion characteristic of all ordinary transformers.

Distributed capacity between turns—hysteresis and eddy current losses—and reluctance to the path of magnetic flux, all were reduced to a point never before achieved in transformer design. In every detail of construction, from the windings of the coils to the outer shielding, electrical and magnetic factors have been co-ordinated to produce that much talked of—but never-before-realized result—great volume without distortion.

### Rigid Tests Bring Enthusiastic Endorsement

Our claims for performance of the Karas Harmonik are enthusiastically endorsed after the many rigid laboratory tests to which they have been subjected by scientists and musicians.

Individuals who have installed Karas Harmoniks in their sets write in most glowing terms of the tremendous improvement in reception. "Supersplendid" is the way one man describes it. "At last a transformer that will give undistorted two stage amplification in a Superhetrodyne", writes another. "The only transformer I have ever found that will handle a reflex circuit" says a third. So it is on every hand. The radio public public is hungry for radio reception of real musical quality. And at last a transformer has been built which DOES produce it.

### Far Better Reception From Any Circuit

No matter what type of receiving circuit you favor, Karas Harmonik Transformers in the audio end will make it a better set than it can possibly be with ordinary transformers Karas Harmonik Transformers are equally superior for regenerative circuits, radio frequency sets, neutrodyne sets, superhetrodynes and reflex circuits.

It requires an exceptional transformer to function properly in a reflex. *It takes a remarkable transformer to handle the big volume of a "super" through two stages.* Yet these are the critical tests that the Karas Harmonik is meeting every day with unvarying success. Users of Karas Harmoniks are more than satisfied. They are enthusiastic boosters.

### An Exceptional Money-Back Guarantee

The remarkable performance of the Karas Harmonik justifies an unusual guarantee. Instead of the usual meaningless guarantee of "material and workmanship" we give you a straight-from-the shoulder, money-back guarantee of *satisfaction.*

Put a pair of Karas Harmonik Transformers in your set. Use them for 60 days. If you do not feel that they are giving you a quality of reception far beyond anything you have ever heard before, send them back to us and we will immediately refund your money without question or quibble. No strings to that offer! No reservations! You can't lose by accepting it.

### Buy From Your Dealer or Direct From Us

Your dealer is authorized to make this guarantee if he has our goods in stock. We are supplying dealers as fast as the output of our factory permits. If your dealer is not yet supplied, use the coupon below. Let us send you a pair of transformers direct. Don't wait until you build a new set. Put Karas Harmoniks in your old one. It's easy to make the change. Ask your dealer today if he has secured a stock of Karas Harmoniks. If not, sit right down and mail the coupon at once. Let Karas Harmoniks make your set produce that perfect musical quality of reception it is capable of giving you.

#### To Jobbers and Dealers

Distribution of Karas Harmonik Transformers through regular jobber and dealer channels is being carried out as rapidly as the output of our factory permits. In the meantime mail applications will be taken care of in the order they are received, on an allotment basis. Write us for test records, discounts, etc.

#### To Set Manufacturers

We positively prove that Karas Harmonik Audio Frequency Transformers will vastly improve the musical quality of your set by any form of test you wish to impose. When you are convinced of this you will naturally want to use them. Write or wire us and arrangements for tests will be made promptly.

***Send No Money with this Coupon!***

**Karas Electric Co., 4040 N. Rockwell St., Dept. 59-42 Chicago**

Please send me .....pair of Karas Harmonik All Stage Ratio Audio Frequency Transformers. I will pay postman $7 apiece, plus postage, on delivery. It is understood that I am privileged to return the transformers any time within 60 days if they do not prove entirely satisfactory to me, and my money will be refunded at once.

Name .....

Address .....

City .....

Dealer's Name .....

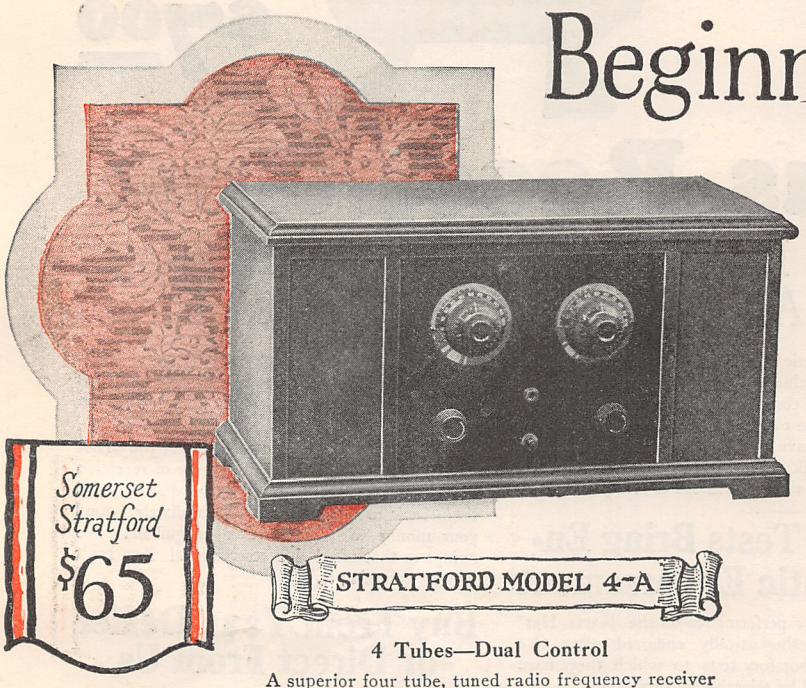
Dealer's Address .....

If you send cash with order we'll send transformers postpaid.

**KARAS ELECTRIC CO., 4040 N. Rockwell St., Dept 59-42 Chicago**

# The New Somerset

## Beginning a NEW




STRATFORD MODEL 4-A

**4 Tubes—Dual Control**

A superior four tube, tuned radio frequency receiver —two dial control—operates on storage battery or dry cells. Automatic filament control insures long life of tubes. The finest "low loss" condensers and the famous SOMERSET Calibrated Transformers are features. "B" battery space is provided in the handsome two-tone mahogany finish cabinet. Size 21" x 15" x 11". **List $65**

### The Day Has Come

TRUTH in radio, from now on, will be the firm foundation on which the public will build its confidence.

Confused and disappointed by extravagant and misleading claims, by high sounding names and mysterious terms, the radio buyer has eagerly sought for an assurance of full value for his money and a definite idea of what he can expect for a definite expenditure.

He has long awaited an honest combination of simplicity, economy, reliability and beauty—of conscientious workmanship in a worthy setting.

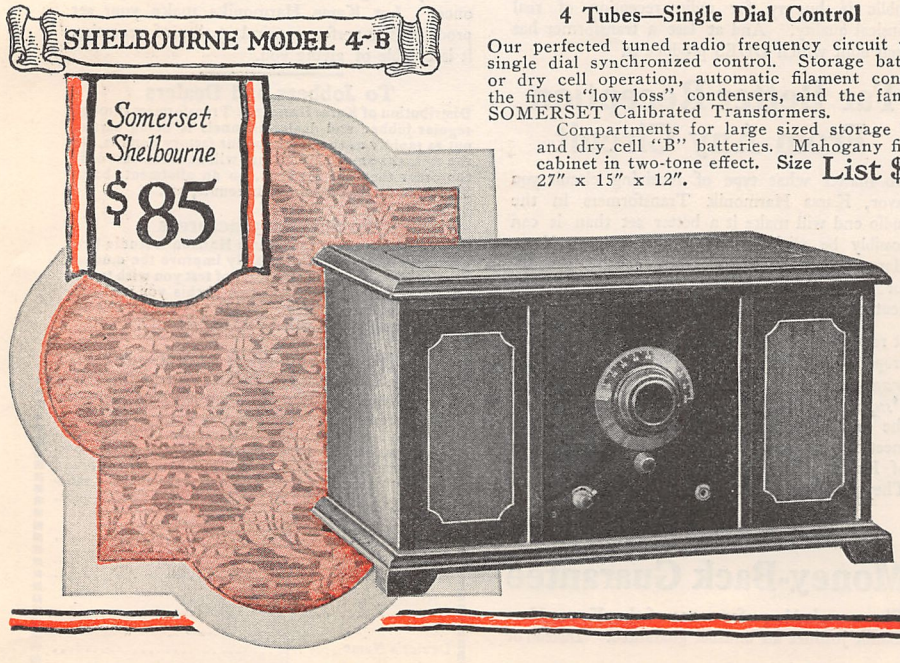
### A New Standard of Value

THE Somerset line has been developed to meet this hitherto unfilled want. To provide a full dollar's worth of radio for the consumer's dollar is its fundamental policy and to this end it embodies the best materials, design and engineering skill available.

Nor is the Somerset line merely an improvement on existing types of radio receivers. Ignoring all precedents, but testing and proving every step of the way, Somerset receivers have blazed a new trail and set a new standard for the future.

Each Somerset Receiver represents the best that can be offered at its price, the utmost in results and permanent satisfaction to the owner.

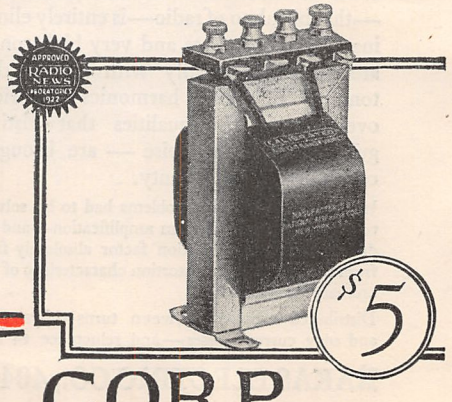
SHELBOURNE MODEL 4-B




**4 Tubes—Single Dial Control**

Our perfected tuned radio frequency circuit with single dial synchronized control. Storage battery or dry cell operation, automatic filament control, the finest "low loss" condensers, and the famous SOMERSET Calibrated Transformers.

Compartments for large sized storage "A" and dry cell "B" batteries. Mahogany finish cabinet in two-tone effect. Size 27" x 15" x 12". **List $85**




## NATIONAL AIRPHONE CORP.

# Line of Radio Receivers

## Era in RADIO

### Efficiency Plus Beauty

DEDICATED to the ideal of radio as an integral part of the modern home, each Somerset Receiver is a substantial and decorative piece of furniture. All cabinets have an exquisite two-toned panel effect with hand-rubbed finish, and are fully up to the standard of the finest phonographs. Each has compartments to hold and conceal the unsightly "A" and "B" batteries with their necessary wiring.

### Guarantee

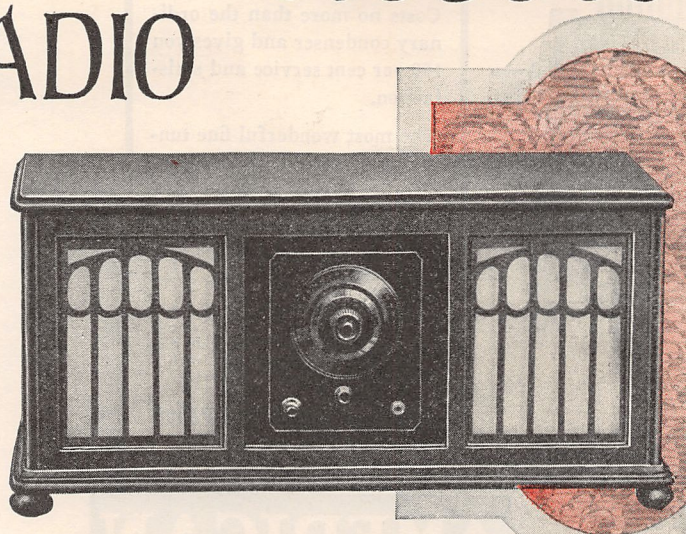
EXTRAVAGENT claims and misleading descriptions will have no part in the sale of any Somerset Receiver. This we pledge—and back it up by a full and definite guarantee that every set is exactly as represented or the purchase price will be refunded promptly and cheerfully.

Here are the complete standard specifications of the four new Somerset models and the makers of these sets challenge comparison with any others as to correctness of engineering design, beauty of appearance, careful workmanship, high quality and suitability of parts and materials used, clarity of reception and faithfulness and purity of tone.

*These are values which can't be matched!*

*Send at once for literature describing the complete new Somerset line of radio receivers—it is well worth your while. Address Dept. A.*

The Somerset Calibrated Audio Transformer—heralding a new and complete line of radio apparatus, developed in the Somerset Engineering and Research Laboratories and all characterised by the same superior design, highest grade materials and painstaking workmanship as the Somerset line of complete radio receivers.



Somerset Standish $150

**STANDISH MODEL 4-C**

Combining a built-in loud speaker of the highest type and the four tube tuned radio frequency circuit with single dial synchronized control—all the latest and best in radio. Storage battery or dry cell operation, automatic filament control, highest quality "low loss" condensers, and the famous SOMERSET Calibrated Transformers. Ample space is reserved in this cabinet for standard size high ampere hour storage "A" batteries and dry "B" batteries. Exquisite cabinet, antique mahogany finish. Size 29" x 13" x 14".

**List $150**

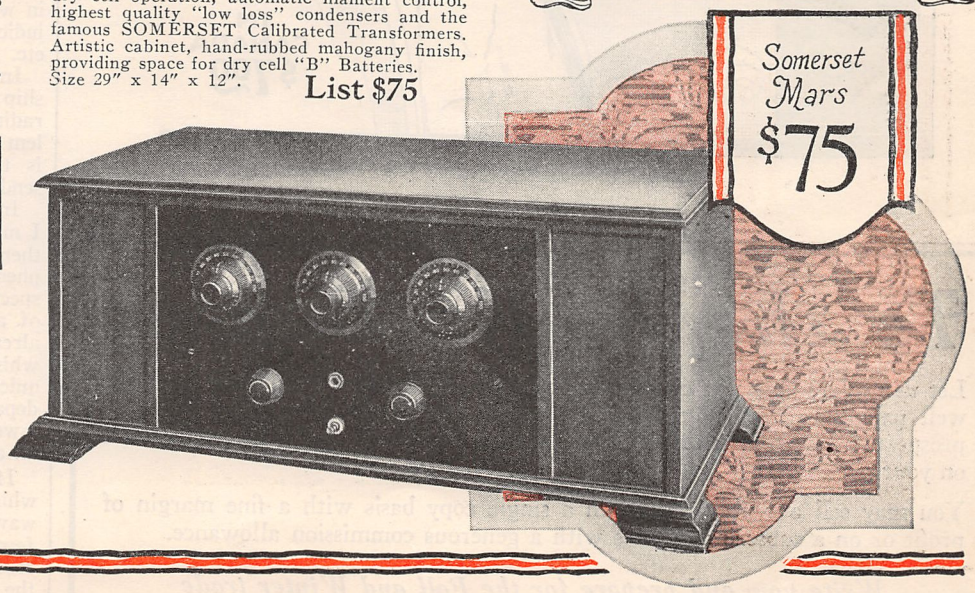
**4 Tubes—Single Dial Control with built-in loud speaker**

**5 Tubes—Three Dial Control**

Two stages tuned radio frequency, detector, and two stages audio frequency. Storage battery or dry cell operation, automatic filament control, highest quality "low loss" condensers and the famous SOMERSET Calibrated Transformers. Artistic cabinet, hand-rubbed mahogany finish, providing space for dry cell "B" Batteries. Size 29" x 14" x 12".

**List $75**

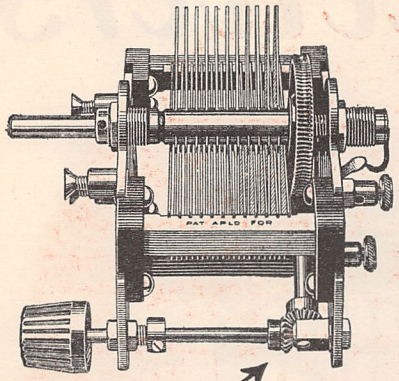
**SOMERSET MARS *Model* 5-A**



Somerset Mars $75

## 18 HUDSON ST. NEW YORK

# 100 to 1



with the Worm Drive Vernier

What is the most important part in your radio? The Condenser, of course!

Then why not have the best—The famous American Brand with the 100 to 1 worm drive vernier.

Costs no more than the ordinary condenser and gives you 100 per cent service and satisfaction.

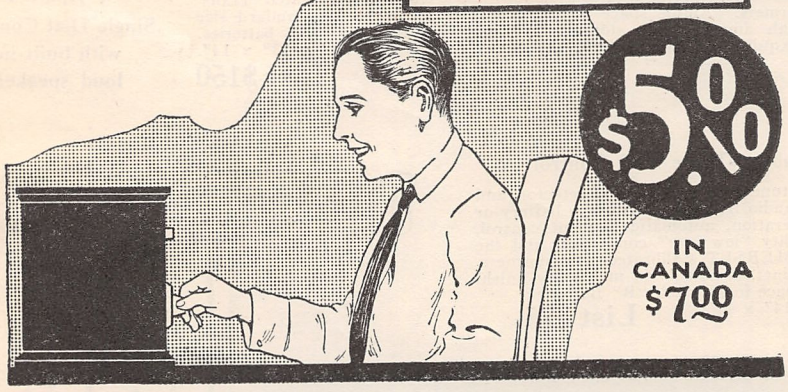
The most wonderful fine tuning condenser ever made.

Ask any Radio Dealer to show it to you and you will at once recognize the superior points of American Brand Condensers.

Note to Dealers: Your jobber is now able to supply you with American Brand Condensers.

**American Brand Corporation**
8 WEST PARK ST., NEWARK

**AMERICAN BRAND CONDENSER**



$5.00

IN CANADA $7.00



# To the Radio Dealer

Let us explain how you can make the sale of our publications a worth while, well paying part of your business. Every one that enters your store is a prospective buyer of RADIO NEWS. RADIO NEWS will sell with little effort on your part.

You may sell our publications on a single copy basis with a fine margin of profit or on a subscription basis with a generous commission allowance.

*Write now and prepare for the Fall and Winter trade*

**Experimenter Publishing Company**
**53 Park Place - - - New York**


However, the new edition covers 900 pages of radio subject matter divided into logical subheadings, and the various subjects treated in clear and untechnical language for the layman, and mathematical language for the skilled man, or the layman who wants through study to become skilled. The treatment throughout is from a totally unbiased point of view.

As is usual with textbooks originating with Naval personnel, publication and sale is undertaken by the U. S. Naval Institute of Annapolis, Md., and officially encouraged, but unofficial organization of Naval officers, which endeavors to give expression to writings of officers and others in the Naval service through the publication of a quarterly periodical, and publication of textbooks on subjects of Naval interest. Only a limited number of copies are available from the first print, but should the book find a large demand, the Naval Institute stands ready to meet all requirements.

## The Significance of Rays In Physics

(*Continued from page* 1418)

the static discharge spark and the arc light with its extremely high temperature give us available means. The eye of the investigator is then enraptured at seeing the spectrum thus obtained with its thousands of lines, such as that of iron or of uranium, but we must in all humility admit how enormously great is the task which he has placed before himself—this plotting out the law of the order of this apparently endless multitude of lines.

### EFFECT OF SPEED

If we give our attention once more to the hydrogen spectrum, shown in Fig. 2, we will notice at once that its principal lines, as already intimated, are arranged with great regularity. Starting at the right end of the spectrum, we will find that they crowd themselves more and more together at the violet end, not indiscriminately but apparently according to some characteristic law of their own. Such a succession of regularly distributed spectrum lines we will call a series. Professor Balmer, of Basel, Switzerland, has succeeded in expressing the law of this hydrogen series in a single formula easy to grasp. If the frequency Vo of the last line is known, the frequency of all the other lines come from the very simple relationship expressed by the formula

$$V = Vo\left(\frac{1}{n^2} - \frac{1}{m^2}\right)$$

in which $n$ indicates the number two and $m$ indicates the whole numbers three, four, five, etc.

In observing this simple law of relationship between the frequencies of the emitted radiations the solution of our principal problem does not seem hopeless, namely: What is the peculiarity of the oscillator which sends out so clear a spectrum?

In order to be able to answer this question I must here seem to diverge from the direct theme, and to call attention to some other phenomena, which leads us, outside of the spectrum, to some conclusions on the natures of an oscillator. Most of our readers will already have made the observation that the whistle of a locomotive approaching us quickly is at a higher pitch than when it is departing, which seems on its part to be lower in pitch. Here we are concerned with an acoustic oscillator in action.

If the movement of the engine with its whistle is toward us, our ear receives more waves per second; if the movement is away, fewer waves per second are received than from an oscillator at rest, and so we receive the impression that the note is higher or is lower than that given by the same oscillator when motionless. Our example is drawn from an acoustic oscillator. Precisely the same thing applies to an optical oscillator, which is moving. On account of the enormously high velocity of light we have to deal with the

# Build the Set you have dreamed of

# TROPADYNE SUPERADIO OUTFIT

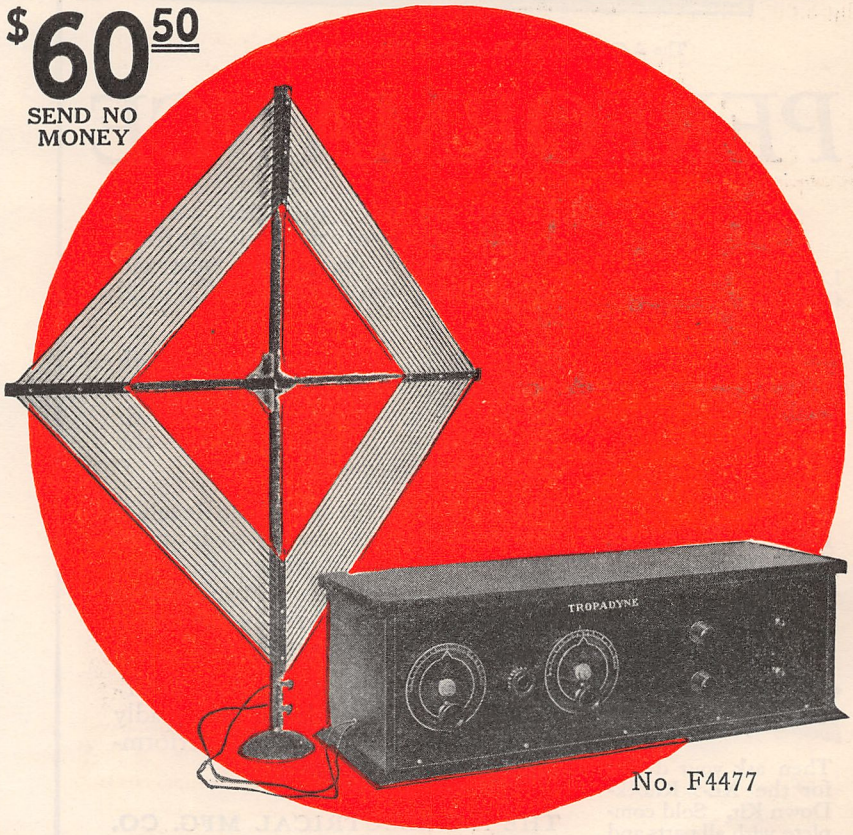
## *Superior to Super-Heterodyne*

**$60.50**
SEND NO MONEY

THIS Superadio 6 Tube Set brings in Station KFKX (Hastings, Nebraska), 1200 miles, in New York City, clearly on a loud speaker, using only the small loop which comes with the outfit.

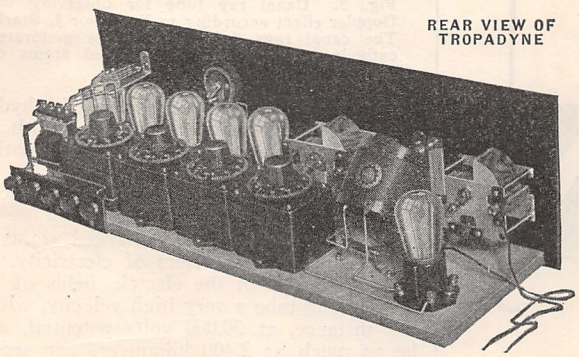
The outfit advertised here is complete, as listed below, everything needed is included, down to the last screw. The charts, blueprints, directions and photos furnished are so complete and explicit that anyone can build this set and have it working within a few hours. There is nothing additional to buy except the necessary batteries and tubes. Price includes mahogany cabinet and folding loop aerial.

You can pay $150 or more for an outfit, or $200 or more for a set, but you cannot possibly buy a better set than this one.



No. F4477

**Your Money Refunded** if this set does not satisfy you in all respects—if after 5 days' fair trial you do not proclaim the TROPADYNE the best radio set you ever listened to.


REAR VIEW OF TROPADYNE

## Note These Important Features:

**DISTANCE, VOLUME AND TONE QUALITY** equal to any 8 tube set sold anywhere at any price.

**LOOP RECEPTION**—Outside aerial not to be used with this set—the complete loop is included in outfit.

**PERMANENT LOGGING OF STATIONS**—Follow chart furnished; there are only two tuning controls and you always find the same station at the same spots on the dials. Our log chart shows you at what point to find any station.

**MICROMETER VERNIER DIALS** giving you the full advantage of the exceptionally sharp tuning.

**OUTFIT IS ABSOLUTELY COMPLETE**—Drilled panel, Mahoganite Cabinet and everything else needed, except tubes and batteries.

**ECONOMY and SIMPLICITY**—This is not a reflex, yet six tubes do the work for which other sets require eight to ten.

## The Editor of the Radio News

In the August 1924 issue, said this about the **Tropadyne:** "Here is a remarkable receiver which we warmly recommend to our readers. It has several new and unusual features. In the first place only 6 tubes are used giving as much volume as the average 8 tube Heterodyne. The selectivity of this set is unusual. Unequalities of the intermediate transformers have now been done away with by tuning each transformer. After the transformer has been tuned, it can be left this way, no further tuning being necessary.

"This system makes for maximum sharpness and maximum volume. Another outstanding point of superiority of the Tropadyne circuit is that it practically does not radiate, thereby not interfering with other nearby receiving stations. A saving of two tubes as well as an increase of selectivity is obtained with this new circuit."

## Complete List of Parts:

4 *RICO* Tropaformers; 1 Standard Variocoupler; 2 *Certified* Low Loss 23-plate Condensers; 1 *Calibrated* Transformer; 2 Jacks; 3 Fixed Condensers; 6 Bakelite Sockets; 2 Vernier Dials; 1 Rheostat; 1 Potentiometer; 1 7x24 Panel; 1 7x24 Mahogany Cabinet and Baseboard; 40 ft. Bus Bar Wire; 1 Folding Loop Aerial; 1 Grid Leak and Mounting; Binding Posts; Flexible Wire; 1 Bakelite Binding Post Strip; 4 doz. Screws; Full Directions.

## RADIO SPECIALTY COMPANY, 98 PARK PLACE, NEW YORK

### Tropadyne Gets Europe!

"Received 2BD, Aberdeen, on November 25th. Results good, except noises. 11:30 to 11:40 talk, from 11:40 to 12:00 piano number. Piano number good, talk poor. Used Tropadyne Circuit."

J. ZIMMER, 157 James St., Newark, N. J.

*The above has been verified by* "RADIO NEWS"

SEE OUR 2-PAGE AD ON PAGES 1378 and 1379 RADIO NEWS

*RN2*

**SEND NO MONEY**

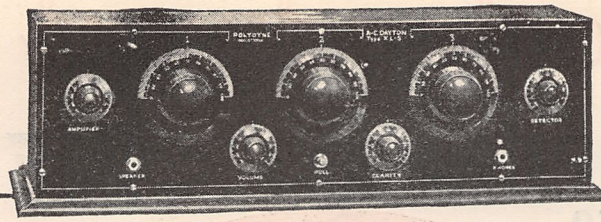
RADIO SPECIALTY CO., 98 Park Place, New York, N. Y.

Please send at once one complete **Tropadyne Superadio Outfit** as advertised in February Radio News. I will pay postman or expressman $60.50 upon arrival.

NAME .....

STREET or R.F.D. .....

CITY ..... STATE .....



The A-C DAYTON XL-5—Dark Mahogany Cabinet.

# PERFORMANCE

$115.00

Less tubes and batteries ($120 Denver and west).

Designed for use with either storage battery or dry cells.

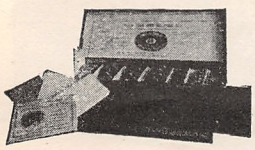
IF you are going to expect consistently satisfactory performance from your new Receiving Set, you will be delighted with an A-C DAYTON XL-5.

In selectivity, volume, wave-length range, ease and simplicity of operation, the XL-5 is unsurpassed. In CLEARNESS of radio reception, it leads the field of fine Receivers.

The XL-5 is a five tube Super Receiver that out-performs any set in its price class. It sells on performance—performance that is a pleasant surprise to the most exacting fan—performance that will more than satisfy you.

Ask to see and hear the A-C DAYTON XL-5. Your dealer will gladly demonstrate its wonderful performance and clear reception.

**Do You Want to Build your own set?**



Then ask your dealer for the XL-5 Knock-Down Kit. Sold complete with all parts and directions for

$72.50

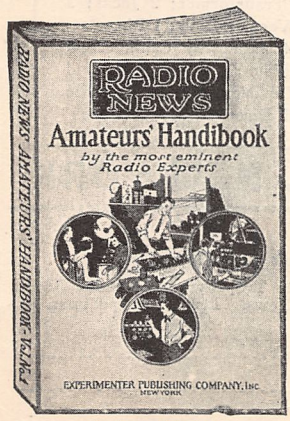
($76.50 Denver and west)

THE A-C ELECTRICAL MFG. CO.
DAYTON, OHIO

*Makers of fine electrical equipment for twenty years.*

*Radio Jobbers and Dealers: We are expanding our distributing organization. Write for complete information.*

A-C DAYTON XL-5

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JUST THE BOOK YOU WANTED

"Radio News"

Amateur's Handibook

*Volume No. 1* (Fourth Printing)

Chock full of radio constructive and instructive articles from cover to cover. Written by foremost radio authorities, in plain everyday language which everyone can understand. Sections include articles on Receiving Sets and Sundry Apparatus, Transmitters and Accessories, Radio Theory, Vacuum Tube Data, and Practical Hints for the Amateur. A book which also serves as a ready reference and should find a place in the library of every amateur. It contains 224 pages and over 375 illustrations, diagrams, and photographs, bound in a multi-colored heavy board. On sale at all leading radio stores. If your dealer cannot supply you, send a dollar bill and the book will be forwarded to you postpaid.

EXPERIMENTER PUBLISHING CO., Inc.
53 Park Place, New York


relative frequency of an altogether different order of values by which a displacement of the rays of the spectrum, either towards the violet or the red can make themselves clearly seen, so as to carry out the analogous acoustic displacement of higher or lower pitch. In honor of its discoverer this is called the Doppler principle, and by its aid it is possible, by the comparison of its wave-lengths or frequencies, to obtain the state of motion of a moving oscillator compared with a similar one at rest. This principle has developed into a very great help in astronomy, so that it is today an easy thing for the observer by spectrum analysis to estimate the speed of rotation of every star by the displacement of its spectral lines compared with a source of the same light upon the earth and therefore motionless. But as we have said before, the observer has to deal with a very great velocity relative to himself, great difficulties long attended the application of the Doppler effect to the movement of terrestrial sources of light. The Russian astro-physicist, Bjelopolsky, first succeeded in this. The material of his classic investigation was, in the main, obtained by him from an American lady. During his residence near St. Petersburg, the author had a chance to admire the extraordinarily interesting apparatus of Professor Bjelopolsky.

Dr. Johannes Stark using the Doppler effect—and that is why we allude to him here—succeeded in determining, with perfect certainty, the nature of the oscillators in incandescent hydrogen. It was recognizable that in a discharging tube, the current was carried not only by the negative electrons, but also by moving positive ions, the so-called canal rays (Fig. 3). If, for example, we fill the canal ray tube with hydrogen, the electro-magnetic analysis, with the help of which we determine the quotient

$$\frac{e}{m} = \frac{\text{charge}}{\text{mass}}$$ of the moving particles,

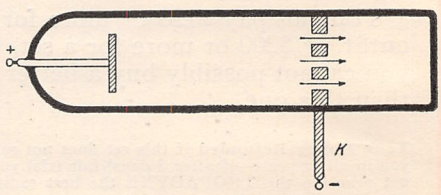
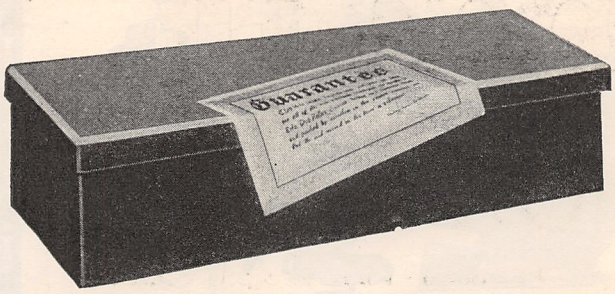



Fig. 3. Canal ray tube for observing the Doppler effect according to Professor J. Stark. The canal rays flow through the perforated cathode; they consist of charged atoms or molecules.

tells us that in this case charged atoms of hydrogen are the carriers of electricity, the atoms attained in the electric fields of the discharging tube a very high velocity, which, for instance, at 30,000 volts potential, may be as much as 2,400 kilometers per second (about 1,500 miles). If we now examine the light which these canal rays produce by using the spectroscope, while the atoms are moving towards the observer, all the lines of the Balmer series appear displaced towards the violet, and to exactly the extent as postulated by the Doppler principle for a source of light, which is moving towards the observer at a given velocity (2,400 kilometers per second). If they are observed from the other points of view, where they are moving away from the observer, a corresponding displacement towards the red is observed. By this fundamental discovery we now reach the definite proof that the oscillators, which emit the spectrum, are the atoms of hydrogen. A more refined analysis shows that here it is not the charged atoms, but the neutralized hydrogen atoms, which possess the power of emitting radiant energy of the spectral relationship indicated. Now as hydrogen in the ordinary condition in which it consists entirely of molecules, sends out no light, we have to accept the fact that

# *For Circuit Supremacy— CIR-KIT and Supereflex*




Erla Supereflex—herald of a new epoch in circuits. Not just a "wave" of popularity; but permanent leadership, because Erla circuit principles are *basically* superior. They represent the farthest advance, as always, ever since Erla introduced the circuits still rated most powerful, tube for tube.

Highest expression of all Erla science, Supereflex circuits also are easiest to own! Not only because of extreme economy in first cost and operation, but also because Erla *CIR-KIT* enables any experimenter to produce these finest circuits without a flaw. *CIR-KIT* provides every needed item of Erla Precision Radio Apparatus—the same specially engineered parts exclusively responsible for matchless Erla range, volume, clarity, sensitiveness and remarkable ease of control.

*CIR-KIT* also provides full-size blueprints; stenciled baseboard; and drilled, lettered panel, so that every step must be correct. Assuring lasting supremacy in circuits; the pride of a truly professional hook-up; and incomparable radio entertainment, *CIR-KIT* is the outstanding radio attainment today.

**Electrical Research Laboratories**
Dept. J, 2500 Cottage Grove Ave., Chicago

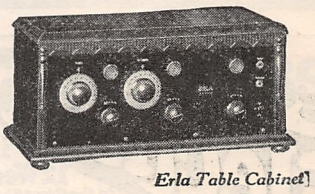
## ERLA PARTS

It has been said that the quality of a radio set may be judged by *looking at it*—to see how many Erla parts it contains. Erla research, Erla design and precision have produced a complete array of superior units capable of improving any set.

*Erla Floor Console*

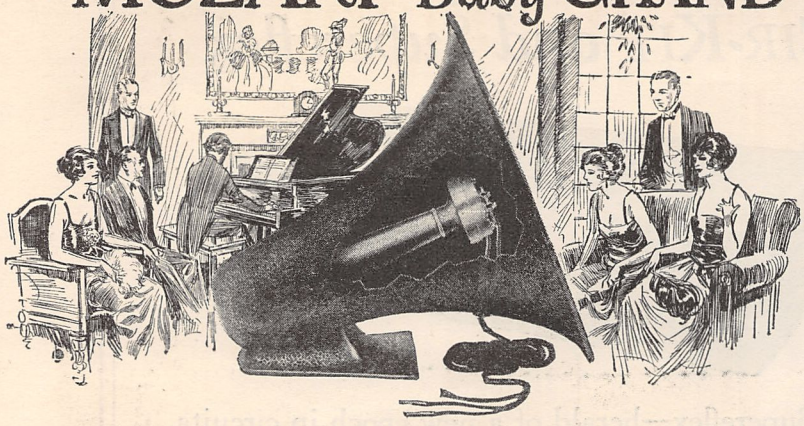
*Erla Table Console*

*Erla complete radio instruments lift radio to the realm of art, with the same superiorities CIR-KIT brings.*


*Erla Table Cabinet*

# ERLA

# The MOZART Baby GRAND



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No piece of radio apparatus even in its price class is the best because its maker says so, or, because its dealer say so. It is only the best when everybody else says so as well.

"I want to say that it is the best I have ever heard. I could hear as well as if I had headphones and that is saying much as I am rather 'hard of hearing.' In fact it was the first concert I ever enjoyed 100% without earphones. Here is to your success.

(Signed) "EUGENE A. WINTER, Buffalo, N. Y."

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| Baby Grand Reproducer, with gold plated unit, black and gold crackle or extra heavy coated all black satin finish (approx. 12" bell) | $12.00 |
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| Electro-magnetic unit (fits almost any horn or phonograph) with cord, nickel plated | 4.00 |
| Gold plated | 5.00 |
| Mozart Special Headset | 6.00 |

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hydrogen atoms must first be brought into some peculiar condition to be able to emit light of the wonderfully harmonic and concrete formation of the Balmer series. The thought now seems to be here that these atomic oscillators must have an especially simple and wonderfully constituted structure, and, in fact, it was this thought which gave the great physicist Nils Bohr, of Copenhagen, no quiet until he brought it to his view of the inner construction of the atom of hydrogen, now universally regarded as firmly fixed. Before we approach this Bohr theory any closer, which we will do in our next article, we must deal with some other important experimental researches, which served Bohr as the foundation for his theory of atoms. Above all, attention must be paid to the fundamental experiment of Sir Ernest Rutherford and H. Geiger, from which we know certainly that an atom is in no sense a small sphere, filled homogeneously with matter, but is really a more or less complicated system, in which the negative electrons like planets, move around a positively charged neucleus, as the central sun of their system. This neucleus, which in comparison to the electron, is of minute dimensions, is the actual bearer of the heavy mass of the atom. In hydrogen, for instance, its mass is 2,000 times greater than that of the electrons, while on the other hand its radius is about 1/2000 that of an electron. In order to give the readers of RADIO NEWS a clear image of the size relation of the atom, for, unless we are accustomed to it, it is difficult to picture such minute dimensions, we will for a moment imagine such an atom magnified to a gigantic size. If we assume, for instance, that the neucleus of a neutral hydrogen atom is as big as a billiard ball, this will be the center about which one electron rotates, which electron will be a sphere of such huge dimensions that a skyscraper building could find place therein, and yet this giant electron would follow a circular path around the neucleus, the radius of which path would be about equal to the semi-diameter of the earth.

The atoms of other elements are more complicated, but in essentials are built upon the lines of the hydrogen atom. The 92 elements, according to their graduated atomic weights, are arranged in a periodic system as we know, so that for every element there is an exactly determined place or atomic number. The simple law applies to atoms that the mass of their neuclii is proportional to their atomic weight and the charge of the neucleus is equal to the atomic number in the periodic system. Thus the helium atom as the second element in the periodic system has a neucleus of twice the charge and four times the mass of that of the hydrogen atom. As its neucleus-charge is two, it follows that in the neutral state it will be the center for the orbits of two electrons. The uranium atom as the last and 92 element in the periodic system will have a neucleus, whose mass is 238 times greater and whose charge is 92 times greater than the same factors in the hydrogen atom. In the neutral condition 92 electrons circulate about the neucleus of the uranium atom.

We will attempt to make our presentation still clearer, for now we have reached the inner structure of matter. Two points are to be especially attended to, which at first glance are confusing; in the first place we have recognized that matter in general appears to consist of purely electric fundamental powers. The second is that what to the ordinary observer appears to be an impenetrable mass, is of a most extraordinary penetrability. We may take the diamond, which we know to be the hardest substance there is, selecting it as a concrete example, and as an especially impressive example, we may take one of the largest specimens in the world, the so-called "Great Mogul" (Fig.

(*Continued on page* 1477)

# Case, Cells and Handles moulded in one piece

THERE are no separate jars in the new Exide 6-Volt "A" Battery. Compartments holding the plates are moulded in one piece with the composition case.

Not only is this battery simple and sturdy, but it is handsome enough to take its place openly in any room. The surface is beautifully stippled and finished in glossy black.

You will find many other refinements in this new battery, but one thing has not been changed—it has the same old dependable power that made the former Exide "A" Battery famous. The flow of current is uniform through a long period of discharge. The life is notably long.

*The New Exide 6-volt "A" Battery*

This new 6-volt battery is made in five sizes—50, 75, 100, 125, and 150 ampere hour capacity.

*Two other "A's" and a new "B"*

For low-voltage tubes there are the Exide 2-volt and 4-volt "A" batteries, weighing only five and six pounds. They are midgets in size but giants in power.

The new "B" battery has 6000 milli-ampere hours capacity. It is assembled in glass jars, thus adding visibility to capacity. You will find this splendid battery full of silent, rugged, long-lasting power. It can be recharged at home most economically with the new Exide Rectifier.

Ask to see the complete Exide line at any Exide Service Station or Radio Dealer's. We shall be glad to mail you descriptive booklets on request.

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia

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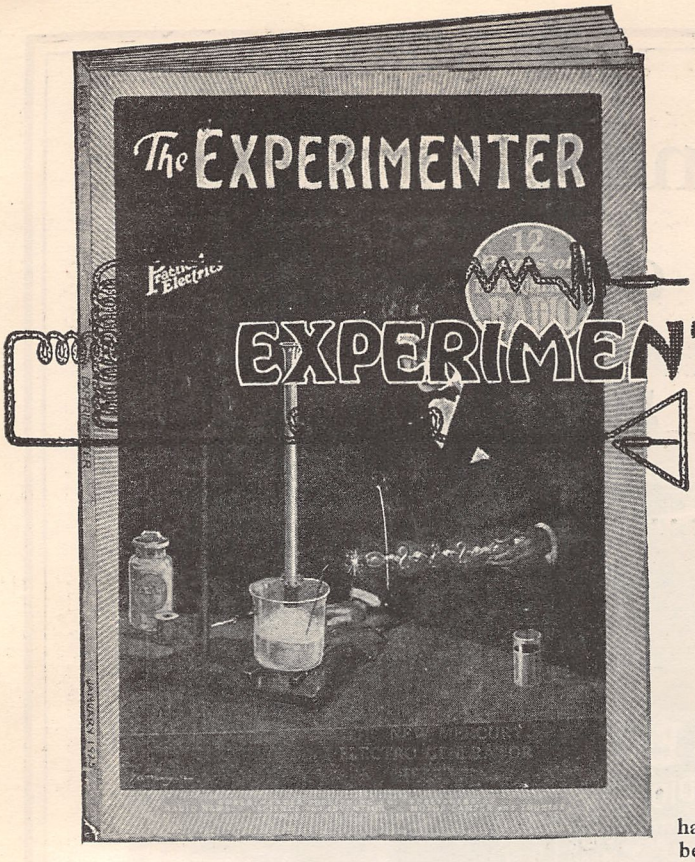
# Exide

## RADIO BATTERIES

*For better radio reception use storage batteries*

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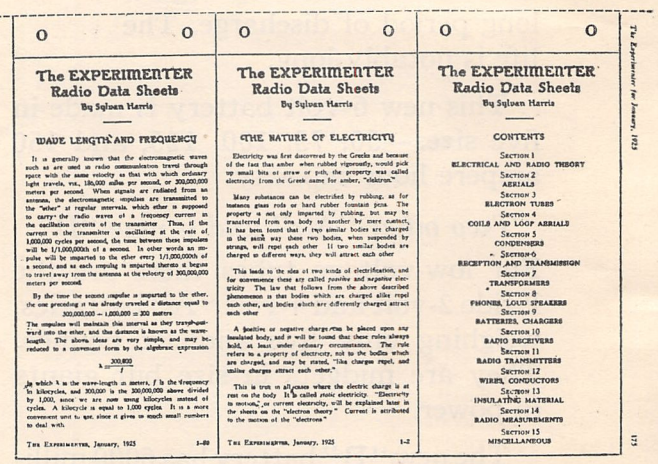
## an open sesame to the great undeveloped field of inventive opportunity

## RADIO

has tremendous possibilities for every experimenter. In fact it has been only by constant inventing and research work on the part of many engineers and designers that radio broadcasting has come into existence. Opportunity knocks at everyone's door *today*—Radio has a hundred problems waiting for you to solve.

The EXPERIMENTER, the one and only magazine expressly for the person who experiments, carries each month many pages of radio that detail the major problems of the industry that are waiting to be solved. The EXPERIMENTER covers completely the field of radio from the standpoint of the development of the industry.



The EXPERIMENTER Radio Data Sheets
By Sylvan Harris

WAVE LENGTH AND FREQUENCY

It is generally known that the electromagnetic waves such as are used in radio communication travel through space with the same velocity as that with which ordinary light travels, viz., 186,000 miles per second, or 300,000,000 meters per second. When signals are radiated from an antenna, the electromagnetic impulses are transmitted to the "other" at regular intervals, which either is supposed to carry the radio waves of a frequency current as the oscillation currents of the transmitter. Thus, if the current in the transmitter is oscillating at the rate of 1,000,000 cycles per second, the time between these impulses will be 1/1,000,000th of a second. In other words an impulse will be imparted to the other every 1/1,000,000th of a second, and as each impulse is imparted thereto it begins to travel away from the antenna at the velocity of 300,000,000 meters per second.

By the time the second impulse is imparted to the other, the one preceding it has already traveled a distance equal to

300,000,000 ÷ 1,000,000 = 300 meters

The impulses will maintain this interval as they travel outward into the ether, and the distance is known as the wavelength. The above ideas are very simple, and may be reduced to a convenient form by the algebraic expression

$$\lambda = \frac{300,000}{f}$$

in which $\lambda$ is the wave-length in meters, $f$ is the frequency in kilocycles, and 300,000 is the 300,000,000 above divided by 1,000, since we are now using kilocycles instead of cycles. A kilocycle is equal to 1,000 cycles. It is a more convenient unit to use, since it gives us much small numbers to deal with.

The Experimenter, January, 1925 1-89

The EXPERIMENTER Radio Data Sheets
By Sylvan Harris

THE NATURE OF ELECTRICITY

Electricity was first discovered by the Greeks and because of the fact that amber when rubbed vigorously, would pick up small bits of straw or pith, the property was called electricity from the Greek name for amber, "elektron."

Many substances can be electrified by rubbing, as for instance glass rods or hard rubber fountain pens. The property is not only imparted by rubbing, but may be transferred from one body to another by mere contact. It has been found that if two similar bodies are charged in the same way these two bodies, when suspended by strings, will repel each other. If two similar bodies are charged in different ways, they will attract each other.

This leads to the idea of two kinds of electrification, and for convenience these are called positive and negative electricity. The law that follows from the above described phenomenon is that bodies which are charged alike repel each other, and bodies which are differently charged attract each other.

A positive or negative charge can be placed upon any insulated body, and it will be found that these rules always hold, at least under ordinary circumstances. The rule refers to a property of electricity, not to the bodies which are charged, and may be stated, "like charges repel, and unlike charges attract each other."

This is true in all cases where the electric charge is at rest on the body. It is called *static* electricity. "Electricity in motion," or current electricity, will be explained later in the sheets on the "electron theory." Current is attributed to the motion of the "electrons."

The Experimenter, January, 1925 1-2

The EXPERIMENTER Radio Data Sheets
By Sylvan Harris

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Section 14 RADIO MEASUREMENTS
Section 15 MISCELLANEOUS

The Experimenter for January, 1925

## RADIO DATA SHEETS

The new radio data sheets of the EXPERIMENTER when completed will constitute a complete course on those important details of radio that every experimenter should have firmly fixed in his mind. They are practical guides to success in your Experiments. They can be removed from the book and kept on file for handy reference. Six sheets every month.

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## EXPERIMENTING as a PROFESSION

### By HUGO GERNSBACK

The following extracts from Mr. Gernsback's editorial in the JANUARY issue of the *Experimenter* will give you an idea of the possibilities in store for the radio experimenter.

"Many of our readers experiment as a sort of hobby, for pleasure or instruction, but comparatively few realize that an experimenter may capitalize his work. Nevertheless, the writer is convinced of this, and he believes that he can readily show you that there is money in independent work of this character."

"In the radio business, particularly, there is today a vast field for experimental work. There is not a radio corporation worth its salt, that could not employ a few more radio investigators to develop a hook-up or a design, or what not."

"To make this clear, a large New York manufacturer of radio sets recently called upon the writer to furnish three experimental research men to perfect a certain set. These people had purchased a patent from an inventor who, however, did not know anything about the commercial work, nor could he make the set work where more than one tube was used. The one tube set worked very well, but the company wanted to produce a four tube set. Wouldn't the writer supply or suggest men to do the experimental work to develop such a set?"

SPECIAL FEATURE—JANUARY ISSUE

### EXPERIMENTAL HARMONICS
### By JOHN L. REINARTZ

John L. Reinartz, one of radio's greatest designers and experimenters has a live, up-to-the-minute article in the January issue of the EXPERIMENTER on his experiments with Harmonics. In a newsy, interesting way he describes his activities and the results of his test. They show how an experienced experimenter goes about his work.

4). This weighs 57 grams, and has a volume of 16 cubic centimeters. A very simple calculation that, as carbon has an atomic weight of 12, in the structure of this diamond, there are $3 \times 10^{24}$ atoms of carbon with $18 \times 10^{24}$ electrons. As in all crystals these atoms each with its own six electrons circulating about it are symmetrically arranged at the solid angles of the outline of a crystal or frame about which movement they can carry out slight oscillation only under the influence of the heat-movement. But if we think for a moment of this arrangement being destroyed and all the neuclii and electrons of this 16 cubic centimeters of matter being gathered in one point, then all these $3 \times 10^{24}$ neuclii would fit into a little cube, whose edge would be $10^{-7} = 1/10{,}000{,}000$ centimeters long, while the $18 \times 10^{24}$ electrons would fill up their own cube the length of whose edge is only 1/10,000 centimeters. Everything else in the diamond is empty space. In order to help along the realization of all this we can again imagine ourselves enlarged to a monstrous size and that the "Great Mogul" has the volume of a giant skyscraper 650 feet square and 650 feet high. Then all of the "electric matter" out of which our "Great Mogul" is built up could be placed within the volume of a copper cent.

The reader will now ask us in wonderment how in spite of this astonishing penetrability of matter — for solid and liquid bodies about the same relation laws apply— diamond and steel can be extraordinarily resistant to cutting forces. The reason is that the electric forces which binds the atom fast in their assigned places in an almost inalterable relationship of space can be extremely powerful. Moreover, one must endeavor to be perfectly clear on a point which perhaps at a first glance contradicts what seems simple, but which point the last investigations in physics seem to have established with perfect certainty. Even the strongest materials from an interchange of forces separate almost little points of charges. We will now in the next article see why the combination of these facts with the powers of the investigation of the spectroscope always lead us to a deeper understanding of the nature of matter.

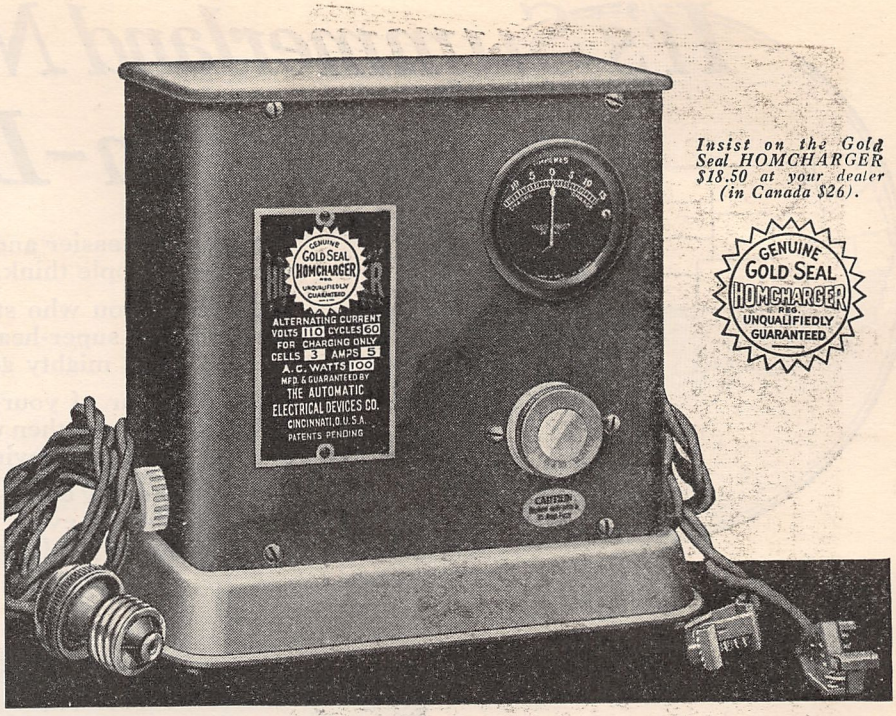
(*To be continued*)

## LEARN TO SEPARATE STATIONS

THE Department of Commerce is so busy these days trying to fit half enough wavelengths to twice too many stations, that complaints of interference do not elicit very hearty or quick responses. This is unavoidable, officials say, so fans must content themselves with the fact that the Department radio chiefs are snowed under with requests for Class B wave-lengths.

With only 53 available wave-lengths, designated by the conference for about 60 stations, the government is now asked to allocate them to 110 B stations. There are 64 B Stations already operating, and 46 either under construction or contemplated, making the application of the original allocation plan practically impossible. Despite difficulties in numbers, there are local situations to be met, and although four of the supervisory districts are apparently fixed up, other supervisors are having difficulties similar to the trouble at headquarters in Washington—too many Class B stations for a division of time on the available wavelengths. Either an entirely new plan will have to be developed, with less space between the channels used, or more wavelengths will have to be secured from other services. An alternative would be to have stations divide time three ways, which it is hoped may be avoided.

Imagine if you can the howl at headquarters when the question was asked regarding when the new list of wave-length


*Insist on the Gold Seal HOMCHARGER $18.50 at your dealer (in Canada $26).*

GENUINE GOLD SEAL HOMCHARGER REG. UNQUALIFIEDLY GUARANTEED

# You needn't have "battery trouble"

## 14 Gold Seal HOMCHARGER Features

1—Simple; needs no care.

2—Efficient; costs about 5c to charge the average battery, much less than bulb or liquid types of charger.

3—Quick; brings battery up to full charge overnight.

4—Tapers charge; cannot injure the battery.

5—Clean; no bulbs to break, no liquids to spill or produce fumes.

6—Dependable; adjusted and sealed at factory.

7—Lasts forever; only one moving part, the Tungsten contact, which can be replaced at $1 after many thousands of hours of use.

8—Fool-proof; charges automatically, no matter which clip is attached to which battery terminal.

9—Safe; approved by Fire Insurance Underwriters. No danger of shock or fire.

10—Beautiful; sturdy metal case finished in mahogany-red and gold.

11—Universal; made in types for all voltages of alternating and direct current. Charges all radio "A" and "B" batteries, and automobile batteries.

12—Quiet; its faint hum cannot be heard in next room.

13—Unqualifiedly guaranteed.

14—Popular price—sold everywhere for $18.50; in Canada $26. Complete, no extras to buy.

**TWO things will make your enjoyment of radio free from battery trouble. First, any good storage battery. Second, that excellent, simple, automatic charger—the new silent Gold Seal Homcharger.**

GOLD SEAL HOMCHARGER

Such a combination means minimum care and maximum results, with no trouble at all. Then you can use your set all you want. If the battery becomes weak right in the middle of a program, screw the Homcharger plug in any lamp-socket, snap two spring clips over the battery terminals, and go right on listening at full power. Leave the Homcharger connected overnight, and in the morning the battery is charged again.

Everybody says this is the handsomest charger ever seen. The Gold Seal Homcharger is finished in mahogany-red and gold. It has rubber feet and so cannot mar polished floors, tables or cabinets. Safe—approved by the Fire Insurance Underwriters. Can't injure anything.

When buying a set, get storage battery tubes. They give most volume, and in many cases better results in distance too. Make sure the battery you buy is charged, then you can listen in for a week to a month before you buy your Gold Seal Homcharger. Price only $18.50 complete; $26 in Canada. Absolutely guaranteed.

**FREE! Ask your dealer or send direct for our interesting free booklet, "The Secret of Distance and Volume in Radio," containing valuable information on this subject and fully describing the GOLD SEAL HOMCHARGER.**

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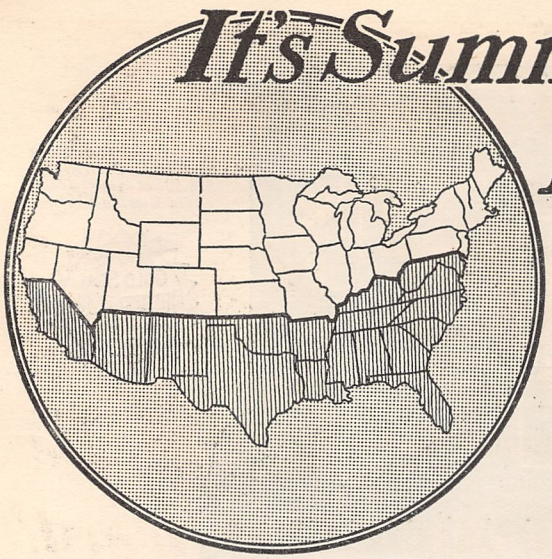

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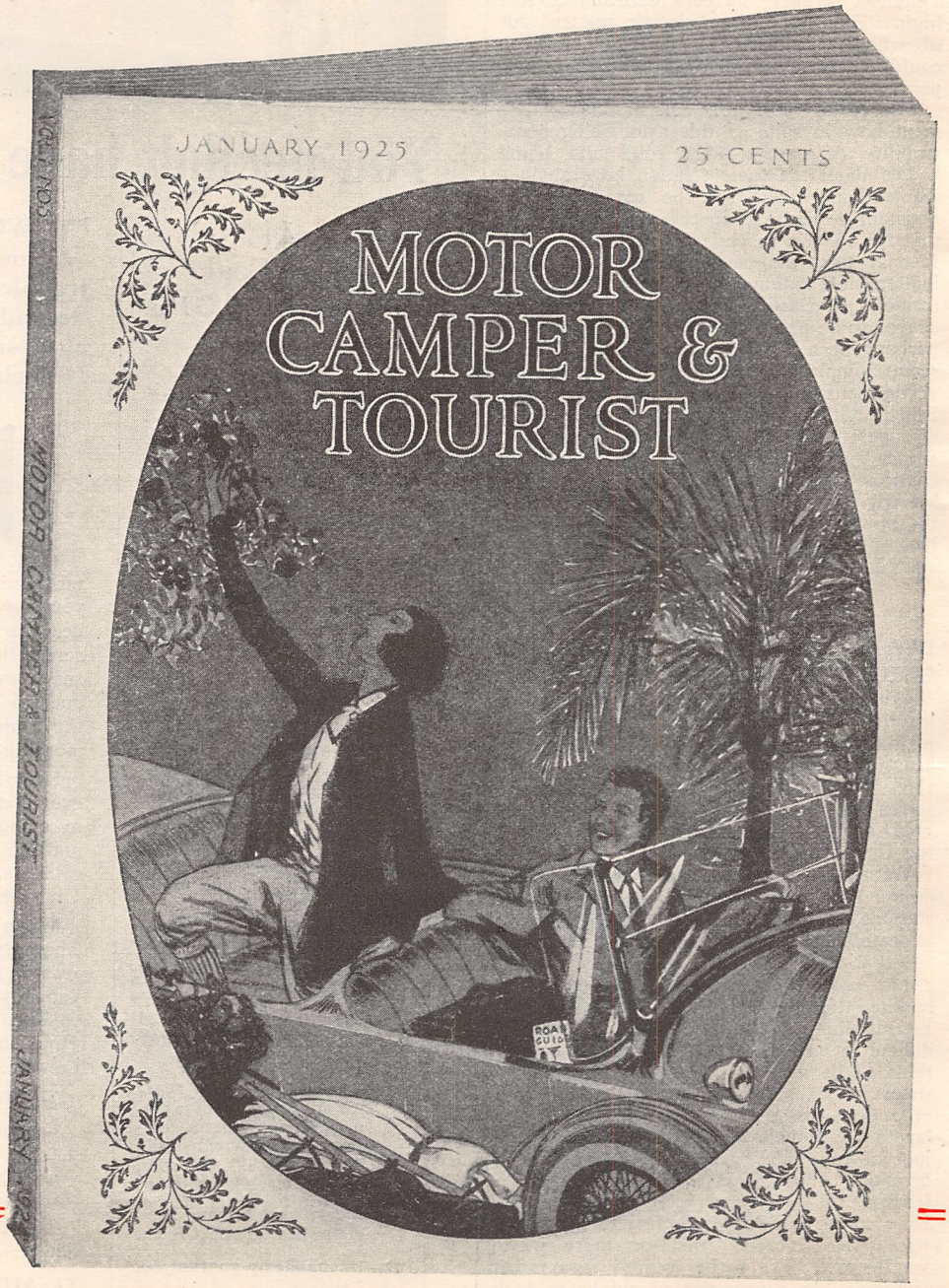
Those of you who store your car all winter and store yourselves in super-heated living rooms for six months are missing some mighty good times.

Get that car of yours out. Read MOTOR CAMPER & TOURIST and then write us for any further information and get your car moving toward the good old Southland.

You will enjoy every minute of the time and get a "kick" out of each and every day on the road. Don't forget to write us for any information you desire.

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allocations would be available. It is not permissible to quote the replies, but they varied all the way from six months to a year, with requests for a method of redistributing them.

The Department is working on a new plan of allocating wave-lengths, and expects to try the method out by tests fairly soon to see if the scheme is a practical one. It is hoped that by the first of the year a satisfactory distribution will be in operation, but nothing definite can be said at this writing.

During the winter months, with better radio reception and more listening-in, Department of Commerce officials point out, super-sensitive sets which are not super-selective must be cured, if interference is to be avoided and trouble in reception minimized. The fans themselves can get better reception, it is believed, by improving their sets, and learning to operate them properly. Due to this fact the Departmental supervisors and inspectors may be expected to refuse to consider complaints unless sets are described. There will be no help if poor receivers are used. If a receiver is like a sponge, absorbing everything, the Department could do nothing to relieve interference unless it caused all except one station to close. There are thousands of non-selective crystal sets on the market and in use, which are impracticable for anything but local reception where one station only is on the air at a given time. If a set is not of two or three circuits, it will probably pick up everything. Practically all crystal sets are of the single circuit variety. In this way many small sets pick up a lot of preventable interference, such as the so-called man-made interference from legitimately operated electrically driven machinery and apparatus. Many manufacturers using electric power and apparatus emitting electrical interference are trying to eliminate their radiations, so as to decrease the broadcast listener's troubles. But it often costs considerable money and is frequently unsuccessful.

By the use of simple wave traps, much local interference from other stations and electrical devices may be eliminated. So it is up to the fan to aid his brother fans and the Government by improving his own set. Some fans will find that by using a two-circuit set or a tuner they can select either of two local stations operating simultaneously, with a reasonable separation between their wave-lengths, as is used in the present wave-length assignment. Otherwise they will find it impossible to listen in when two or more stations are operating at once. Unless fans learn to tune their sets, they will get even the amateur stations on the short waves below 200 meters.

Before you complain the next time be sure your set is a reliable one and that it is operating properly, and that you have taken the usual precautions to prevent its radiation, thus aiding the government inspectors.

---

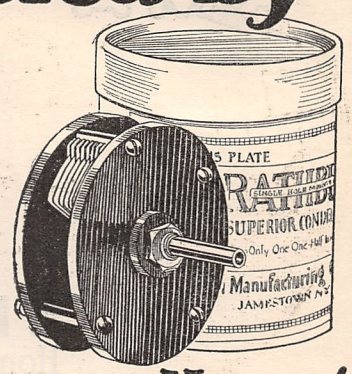
### NAVAL RADIO DEVELOPMENT

RADIO developments of the Naval Research Laboratory in the past fiscal year have proven a direct monetary saving to the Government far in excess of the money expended in radio research problems, and have resulted in a marked increase in naval communication efficiency both afloat and ashore.

In his annual report to the Secretary of the Navy, Dr. A. H. Taylor, of the Radio Research Section, states in part, as follows:

"The laboratory makes a monthly check of shore station transmitting frequencies, thus assuring their working on designated wave-lengths. Apparatus has been developed to give a ready means of frequency calibration for all vessels afloat, and this will not only speed up communication between any two stations, but, with improved apparatus, will make available more communication


# Are You Fooled by "Low Loss" BUNK!




## A RATHBUN Condenser is *Honest!*

## WHY?

BECAUSE NO CLAIMS ARE MADE FOR IT THAT CANNOT BE SUBSTANTIATED. It is not only LOW-LOSS, but HIGHLY EFFICIENT (see Lefax report). LOW-LOSS, a questionable phrase, usually adds $2 or $3 to the price of a condenser. Metal End Plates Do Not Necessarily Mean Low-Losses. EDDY-CURRENTS must be taken into account. These do not exist in BAKELITE End Plates. They are often more serious than dielectric losses at radio frequencies.

**Experts Say**

"Replacing the dielectric material in a condenser by metallic materials for the purpose of lowering its resistance, may not always bring the results that are desired. What is gained in the way of reducing dielectric absorption may be more than overbalanced by what can be lost in the way of eddy-currents, etc. This, in fact, may be pronounced, as we go toward the ultra-short wave lengths, for it must be remembered that eddy-current losses and skin-effect go up rapidly with the frequency, while dielectric absorption goes down."—SYLVAN HARRIS.

"Losses due to eddy-currents in metal end plates of condensers are more serious at radio frequencies than in condensers using a good dielectric material, such as Bakelite."—H. F. HARMON, Engineer; formerly of Bureau of Standards.

Statements that say:

"Our Condenser has NO-LOSS"

"Our Condenser has LOWEST-LOSS"

"Losses CANNOT BE MEASURED"

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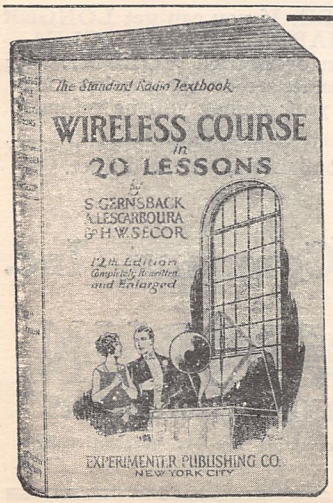


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channels in the range of frequency bands assigned for naval use.

"Incident to the phenomenal growth of broadcasting, it has been found that some of the naval high-power transmitting stations cause interference in reception of radio programs in their immediate vicinity. An extended study of such interference is being made to find means for removing this objectionable feature without excessive cost to the Government.

"Aircraft radio transmitters have been designed with a master oscillator to insure a constant wave-length. This transmitter makes possible an increase in the number of planes which can be used for spotting purposes. A simple audio frequency trap has been developed which permits an increased number of communication channels without increase in the number of transmitters and receivers. As this unit can be built at about one-tenth the cost of present commercially available equipment, and represents a saving of about $100 per set where over 1,000 receiving sets are involved, its value to the Government is apparent.

"As a result of the operations of the Shenandoah there was created a need for reliable radio communication. The work involved was rendered difficult by the fact that no previous data regarding operating conditions on such a ship was available. The laboratory developed and built a high-power tube transmitter, weighing only 450 pounds, exclusive of power plant, capable of putting 2 kilowatts in the antenna, and operating on a range of 200 to 600 kilocycles. It also built a small high frequency set, continuous wave and telephony, for which power is supplied by storage battery. For reception, three receivers covering ranges from 12 to 6,000 kilocycles were designed and built. Weight being of prime consideration, this factor introduced many novel features in design. The apparatus has given excellent results. The receivers developed for the Shenandoah proved of such value that they are being duplicataed for fleet test with a view of possible adoption as standard receivers for all ships."

During the year the Navy installed primary tube transmitters on 18 batatleships, and secondary tube sets for communication with observation aircraft, improving both types of communication considerably, and reducing interference. Three battleships and a cruiser were equipped with duplex systems enabling them to conduct simultaneous communication and reception on four receivers and transmitters, speeding up traffic and eliminating interference. Another improvement was the installation of a method of using the same antenna for multiple operation on a single ship, decreasing the number of aerials previously necessary. Submarine radio equipment was improved to give increased range.

New equipment for aircraft included 15 type SE-1385 transmitters, which give a reliable daylight range. New types of 7½ and 50-watt vacuum tubes, increasing the efficiency of transmitters from 35 to 50 per cent., were developed at the radio laboratory. Another achievement was the adoption of tubes for reception requiring a filament potential of two volts, which resulted in a saving of 66 per cent. in weight of storage batteries required in aircraft. Small plate batteries weighing one pound and nine ounces were substituted in place of five pound batteries previously used in airplanes.

The design of a new high-speed key for the Army set at Arlington, makes the transmission of 100 words per minutes to Fort Benjamin Harrison possible. On the reception end, a new high-speed automatic radio telegraph recorder was developed, making 100 word reception possible, even when static is very bad.

WORKRITE RADIO SETS WORK RIGHT

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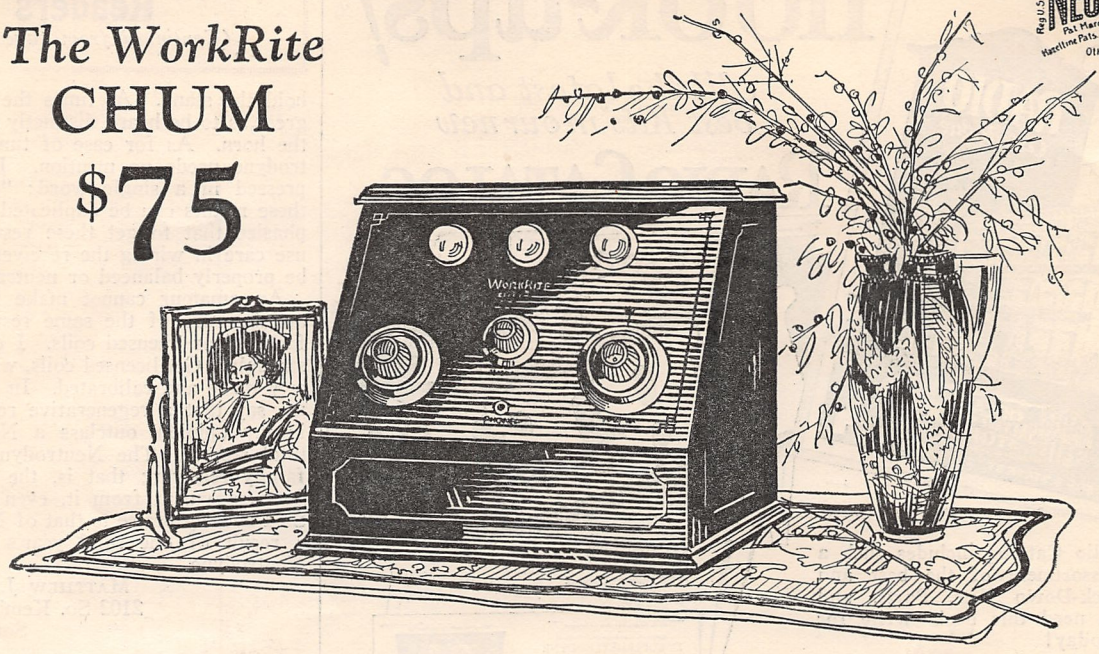
## *The WorkRite* CHUM $75



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The WorkRite Chum has a remarkable range. Distant stations—fully a thousand miles away—come in clearly and distinctly on the loud speaker. Under favorable conditions the Chum will cover a much larger area—and without whistles, howls or distortion to spoil your fun.

It has selectivity, too. Tunes out local stations and brings in others clearly and sweetly as can be.

This beautifully built set is self-contained. There is space in the handsome dark mahogany cabinet for both A and B dry batteries. It works with any kind of an aerial—outdoor or indoor—and is always ready for instant use—any time or any place.

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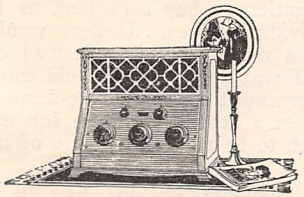
*Branches:* Chicago, 536 Lake Shore Drive; Los Angeles, 239 South Los Angeles Street



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Encased in genuine brown mahogany cabinet with graceful sloping panel. Distortionless loud speaker built into cabinet behind handsome grille. WorkRite Air Master is almost identical with Radio King except it has no loud speaker.

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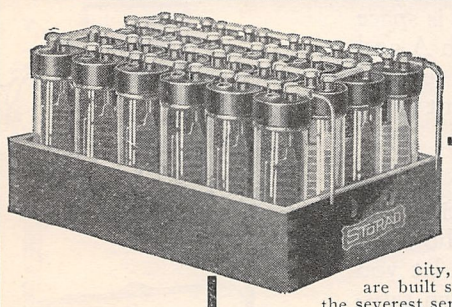
**Remember our motto: Salvage means—**
**SAVE, SERVICE, SATISFACTION**



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Satisfactory results with the new receiving sets can be obtained only with the use of large capacity, heavy duty storage "B" Batteries—batteries that are built special for this purpose in order to stand up under the severest service requirements. At the same time compactness is necessary.

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Experimenter Publishing Co., 53 Park Place, N. Y. C.


## Correspondence from Readers

(*Continued from page* 1434)

hold the stand. At times the volume is so great as to be heard distinctly 150 feet from the horn. As for ease of tuning, the Neutrodyne needs no mention. It can be expressed in a single word: "Simple." All these results can be duplicated but I do emphasize that to get these results one must use care in wiring the receiver, and it must be properly balanced or neutralized.

An amateur cannot make his own coils and be sure of the same results as manufactured or licensed coils. I emphasize this strongly. Get licensed coils, which are properly made and calibrated. In conclusion, let me say that a regenerative receiver cannot, in my opinion, outclass a Neutrodyne for total results. The Neutrodyne is mainly a family receiver; that is, the whole family gets enjoyment from it, even the DX bug. So I add my praise to that of Mr. Earnest as a result of one solid year's work with a Neutrodyne.

MATTHEW J. SAREC,
2102 So. Kemble Avenue,
South Bend, Ind.

### A SUGGESTION FOR RADIO DEALERS

*Editor*, RADIO NEWS:

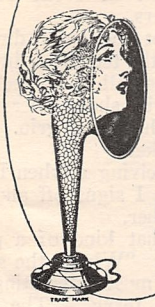
It seems that almost no one is satisfied with his first set and speaker, and those who really become interested, appear to be the large enough majority. Considering the wishes of fans who desire to buy better sets and speakers, as well as relieve the harassed dealers who are asked all sorts of questions as to what it will do on a loop, or indoor antenna, and volume and distance, would it not be a good idea for dealers to arrange a permanent show, jointly, where the prospect and return-buyer could tune-in under the approximate "air" conditions they would encounter in residence use? A radio store is apt to be located in the poorest "reception" part of a city, and home demonstrations require a large, continual stock, and it is an actual occurrence that dealers who leave a set for several days in a prospect's hands have lost sales of certain models because they were "out" when people called at the store for this particular model.

Under the above plan, several prospects could see the same set in operation at one time; those who wished better outfits could compare receivers and speakers without feeling any obligation to buy something as in entering individual stores. Dealers would need only one model operating instead of several in different homes, and should enter into joint agreement against home-demonstrations unless a deposit be made for the use of the set, to be retained in case of no sale.

The most common mistake of "first-buyers" seems to be allowing price to govern choice of purchase. And this in turn is influenced through hearing many repeated stories of results obtained from home and factory manufactured "one-tubers" that closer inspection discloses were made under unusual conditions, if not exaggerated, thus leading to false ideas as to what the average user may expect.

It would seem desirable at the present stage of radio that newspapers and magazines should require verified proof of long-distance records to prevent fostering this idea leading to later disappointment to the novice.

A. H. KLINGBEIL,
258 Prospect Street,
Ashtabula, Ohio.



# Atlas

TRADE MARK

## RADIO REPRODUCTION speaker

ATLAS floods the room with the best that's in your set. Write for the interesting booklet you ought to read before buying *any* speaker.

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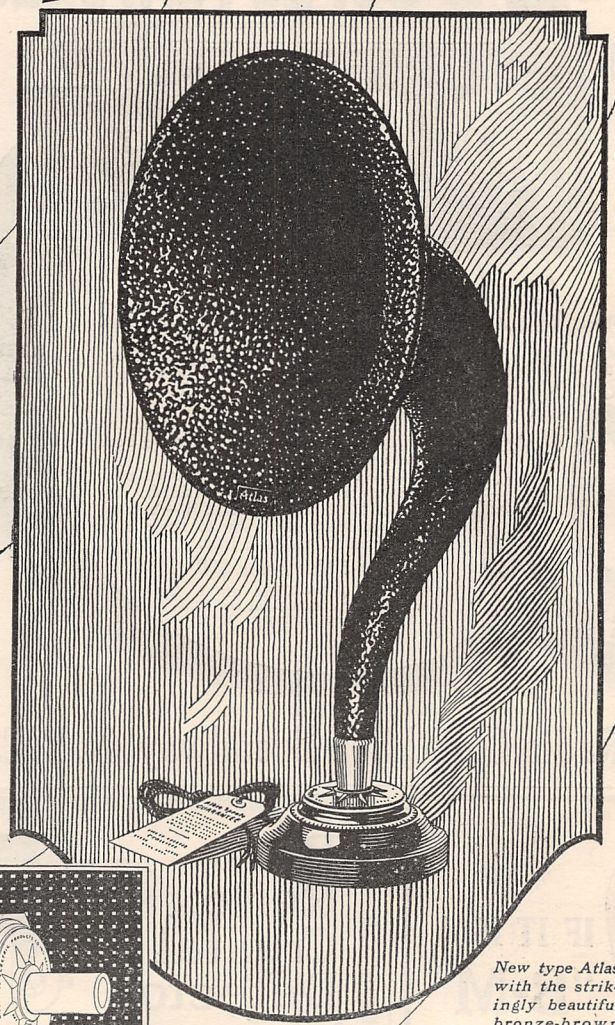
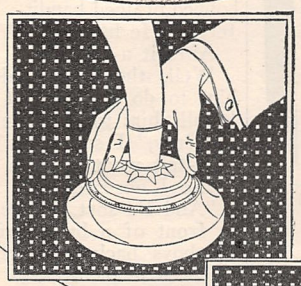
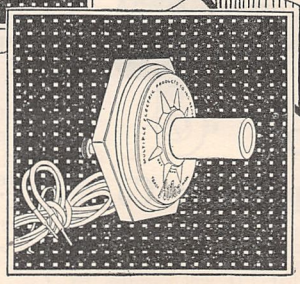




*A slight turn of the exclusive Atlas harmonizer (Pat. applied for) — and your speaker is harmonized with the broadcast you are hearing and the set you are using. It gives you radio—as you ought to hear it.*



*Atlas unit, with attachment couplings to fit all standard phonographs.*

*New type Atlas with the strikingly beautiful bronze-brown ripple-finish gooseneck horn.*

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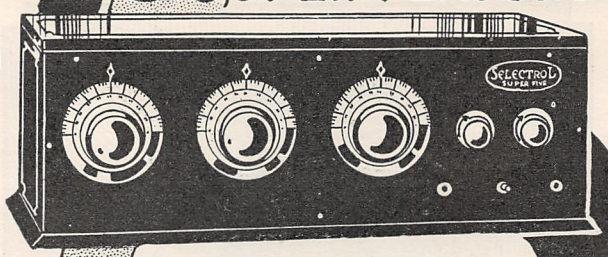
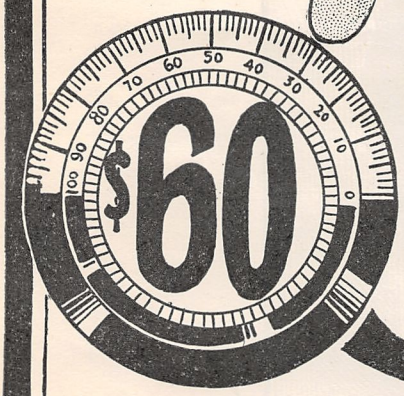
Radios Newest Achievement
The SELECTROL
SUPER-FIVE
A 5 TUBE SET with 5 SUPER FEATURES




MONARCH of the Air

*The Selectrol Dial Tells the Story!*

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2—TUNOFORMERS—3 equally balanced Tuned Radio Frequency Coils matched with low loss condensers. No howls! No squeals! No oscillation.
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4—BEAUTY—A fine hand-grooved cabinet in Adam brown mahogany finish.
5—BATTERY CONNECTOR—A varicolored cable enabling you to make right battery connections in a jiffy.

***and the price $60***

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It is a Better Made Tube.

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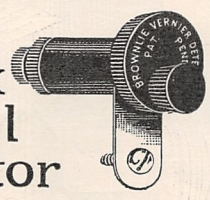


Says the **Acme Apparatus Co.**

No longer does the whisker scratch the crystal, or is the sensitiveness killed by heavy spring pressure—the Vernier Regulator takes care of that. It will surprise you to know how sensitive Crystal Detectors are when correctly made.

**BROWNLIE VERNIER DETECTOR**

For Panel or Base Mounting including Crystal. Guaranteed **$2.00**

At your dealers otherwise send purchase price and you will be supplied postpaid.

ROLAND BROWNLIE & COMPANY
22 Saunders St., Medford, Mass.


## The Master Puts One Over

(*Continued from page* 1400)

*Damped But Not All Wet,* the stupendous radio feature now being produced by the Scaremout Pictures Corporation."

"Oh, you're a director!" gulps the meal hound, whose one ambition is to register emotion in front of a flock of celluloid grinders.

"Not the chief director," explains Jerry. "Just the technical director. My duties are to see that all radio technicalities are correct."

Doris shows her disappointment and I can't help but grin. "Stand by, fair one," I snickers.

Receiving a when-I-get-you-alone smile in return I signs off and lets The Master have the ether.

"What kind of a picture is it?" inquires Doris. "What's the story?"

"A most interesting one, in my opinion," states Jerry. "The plot revolves about a certain old Spanish mission situated on a rocky point overlooking the Pacific Ocean. The present owner of the mission is a radio inventor, busily engaged in perfecting a new device for signaling Mars. A band of plotters hope to secure this invention by kidnaping the professor's daughter and holding her for ransom. The father, frantic for the safety of his child, is about to give in, when he receives a radio message from his daughter, she having secretly made an elementary transmitter out of some old Ford parts. He manages to bring her back, but is pursued by the plotters, who cut all telephone, power and radio wires and lay siege to the mission. The inventor's assistant hurriedly devises a hand-driven generator and with this makeshift sends an SOS to the army, the navy and the police. These arrive just as the crooks are about to storm the mission, and so they all live happily ever after, and the hero marries the girl."

"Huh?" I exclaims. "Who's the hero?"

"Oh, he's one of the marines that the girl has taken a fancy to."

I shakes my head sadly. "That's a dirty trick to play on a hero—hold him off until the tail-end clinch."

"Why, I think it's wonderful!" puts in the bobbed brained bandit. "Don't you mind him, Jerry. He has no soul."

Ain't it a pity?

Well, the Master decides it's time for him to do the asphalt glide for home, so I pulls him to one side for a moment.

"Jerry," I says, "my spare rib has had a long-felt want to be a movie queen."

"So I observed."

"And I'd sort of like to get my mug shot in front of a bunch of Kleigs, just to tell the boys back on Forty-second Street that I'd been in pictures."

"Really?"

I explains. "Our contracts won't let us do any real parts, which for myself I wouldn't if I could, but we'd both sorta like to get shunted into a coupla mob scenes, just for fun, if you could fix it."

Jerry scratches his pompadour. "Well, you're only available for picture work mornings, which would make things a bit difficult—oh, yes! I think Mr. DeFrill could use you. In fact, Joe, since you know radio, you may be able to secure the part of the professor's assistant."

"Hurray for our side!" I snickers.

Well the next morning we arises early and packs our toothbrush over to Jerry's domicile, one of those big houses built for small families. The Master's gone to work, advises the front door flunkey, taking our grips and handing us two passes for the studio. So we yellowcabs over to the flicker factory and hunts for Jerry.

# One Master Control

THE improved Thermiodyne is the newest achievement in Radio. Think of being able to hold the newspaper program in one hand and with the other operate the one control knob. Set the arrow at wavelength listed to get any station you want. No guesswork at any time — if it's in the air Thermiodyne will get it regardless of distance, no distortion, no howling.

Never any interference between distant and local stations. Four refiners stabilize the variations in broadcasting and regulate volume.

The principles of Thermiodyne are new—the most advanced achievement in recent radio development. SIX TUBES ——3 stages of thermionic frequency, detector and 2 stages audio frequency—all singly controlled.

Have your dealer demonstrate Thermiodyne for you. If you've never listened to Thermiodyne reception you've never really heard radio in its most advanced stage.

***Price $140***
*Without Accessories*

***DEALERS and JOBBERS***

Write for particulars regarding territory franchise for this most remarkable seller. A few openings available—act quickly.

***Unconditional guarantee backs every sale.***

THERMIODYNE RADIO CORPORATION - PLATTSBURGH, N. Y.

# Thermiodyne TF6

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Hommel's policy of referring customers to their local dealers means additional sales and real money profit to them.

We make the co-operation between our dealers and ourselves as close and as tangible as is possible.

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Your name could just as well be on our dealer list, and you could profit just as these dealers are profiting.

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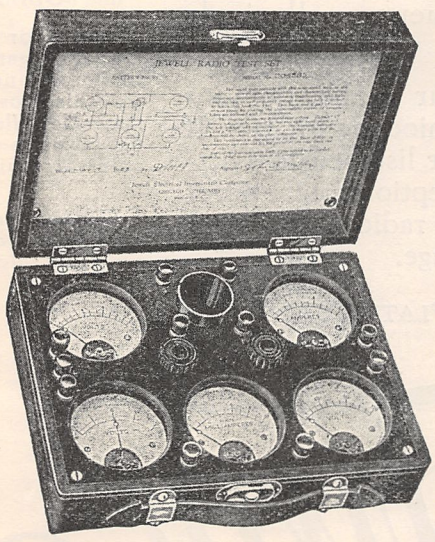

## *The* JEWELL Radio Test Set

This radio test set has been designed to meet the demands coming to us from serious experimenters, manufacturers and dealers in radio equipment and supplies, for a complete radio testing outfit.

While the various ranges of readings permit making practically every test necessary in connection with radio receiving sets, it has been particularly designed for the taking of characteristic curves on vacuum tubes, the only extra equipment required being the batteries.

The several instruments, any of which may be used independently, include a 0-1.2 filament ammeter, a 0-6 filament voltmeter, a 0-120 plate voltmeter, a 0-10 plate milliammeter, and a 10-0-10 grid voltmeter.

**Complete with Instructions**
**Price, $75.00**

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No. 95 *"25 Years Making Good Instruments"*

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After half an hour's search w finds The Master busy supervising the loading of three grid leaks onto a five-ton truck. The director, Mr. DeFrill, is there, and Jerry introduces us. We're surprised to learn that the director has heard of us. Directors hear so little. So we gets our parts, me the assistant and Doris the housemaid.

"In the movies at last!" sighs the dear one rapturously. "Joe, isn't it thrilling?"

"Uh huh," I replies. "Say, Mr. DeFrill, do you make bathing girl comedies here?"

"Not at present," he informs me.

"Stand by, fair one," mimicks Doris. And they tell me murder is illegal!

The director saves the day. "You two had better get ready," he says. "Dressing room number 31. Report to truck 9 in half an hour for location."

To make it abbreviated, by 10 o'clock we're at Vantage Point, whereupon stands an old Spanish residence that was an antique when Patrick Henry got liberty or death. Part of the building has been converted into a studio, so that practically all of the filming is done right on the spot. The company takes a few minor exteriors and then we're all called inside.

"In order to accommodate Mr. and Mrs. Hammerstein, we'll shoot the laboratory scenes immediately," says the director. "Get ready."

Things is running easy. One long room has been fitted up as the Professor's joint. It's genuine, thanks to The Master. At one end is a dummy radio station, a masterpiece of complicated art. Jerry can find more excuses to string wires—but never mind.

"Now," says Mr. DeFrill," the enemy is storming the house. You, Mr. Hammerstein, are at the radio, frantically signaling for help. The mob is beating down the doors, and you're desperate. It's live or die. Make it realistic—just imagine that the mob is trying to murder you!"

"Not much of a mob," sighs the assistant director. "Looks sort of weak."

The director sighs too. "Yes, I know we're handicapped. We should have a real mob of desperadoes, another mob of policemen and a third gang of marines. As it is, we'll have to do some tall doubling. First we'll use the extras as cops, then as marines, and finally as roughnecks. I should have three sets, but I'm over my cost limit now."

"Yes, I know," sighs the assistant.

The director, however, brightens up. "We must make the best of it. Mr. Hammerstein, you will take your place as I told you."

I sits down and goes through my feverish antics of calling for succor. At this juncture The Master makes a suggestion.

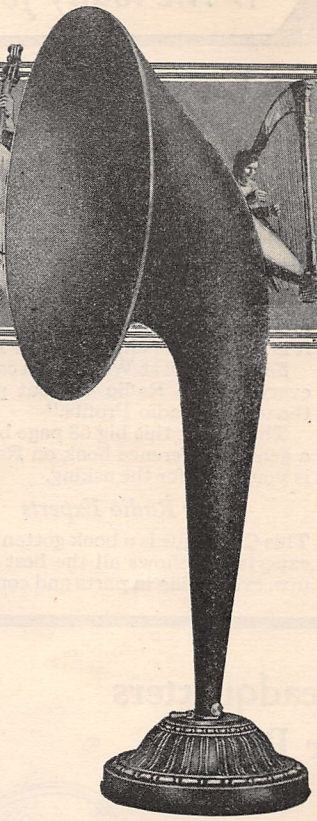
"Joe, that rotary spark gap up there is wired in to create a flashy effect in the picture. I notice you're just tapping the key. Better send regulation stuff, because the hams in the theatre will read your sparks."

"Good idea," says the director.

The cameraman butts in. "Say, canya put a little more pep into that spark? It won't photograph very good that way."

Jerry meditates a few seconds. "I've nothing smaller than a 10-kilowatt transformer," he says. "I guess the gap will stand the load for a few minutes."

So he hooks in the big boy and the report coming from that rotary gap sounds like a contest between the cannons at Sandy Hook. However, the sparks have a good camera personality, so I speaks my little piece and sends a yelp for the army, navy, police and Red Cross. It's pretty, all right, and the director's pleased. Then we takes a few shots of the spouse cleaning the floor and looking through keyholes, and we're



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AUDIOPHONE
$25.00

Rubber horn 14½" in diameter. Cast metal throat. Velvet mat finish or mottled bronze and gold.

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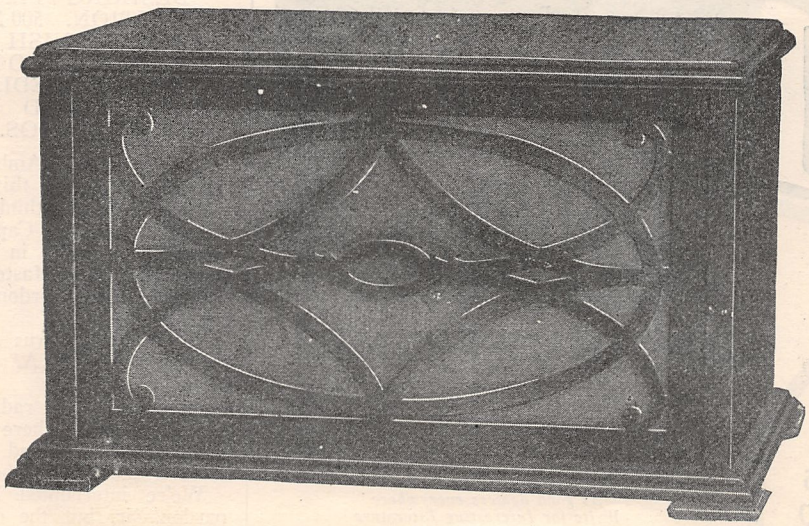
HERE is the test of a loud speaker. Tune in a great orchestra. Do you hear a grand ensemble in perfect harmony? Or,—do the upper tones of the violins, the flutes, the oboes and the clarinets come in a trifle "flat"?

Music—not mere noise—is what you should demand in a loud speaker these days. And music is not music unless it is harmony.

The Bristol Audiophone brings in voice or instrument in perfect tune just as it sounds in the studio. This is because it is itself a true musical instrument; not merely a phone unit in a horn. You will love your Audiophone as you would love a fine violin.

There are five Bristol Audiophones, priced from $12.50 to $30.00.
If not at your dealer's, write for Bulletins No. 3011, 3017 and 3022-S.

THE BRISTOL COMPANY, WATERBURY, CONN.



CABINET
MODEL
$30.00

Beautifully finished mahogany. Full floating wooden horn and cast metal throat. Musically, a companion to the finest set ever built, size 17x10 x10¼".

# BRISTOL AUDIOPHONE Loud Speaker

TRADE MARK
REG. U.S. PAT. OFFICE

*Write today for your FREE copy of—*

# Ward's New Radio Catalogue

THIS advertisement is published to tell you three things that everyone interested in Radio *should know*.

That we believe Ward's is today the greatest Radio store in the world—that it is the real Headquarters for Radio.

Second, that at Ward's you can buy everything in Radio without paying the usual "Radio Profits."

Third, that this big 68 page book—a genuine reference book on Radio—is yours free for the asking.

*Our Radio Experts*

This Catalogue is a book gotten up by experts. It shows all the best hook-ups, everything in parts and complete sets—so simple that you yourself can easily install them.

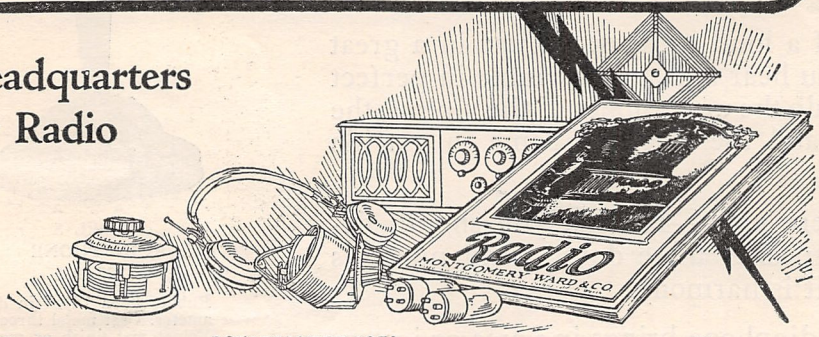
And it shows only tested and approved Radio equipment—selected by our Experts who are up-to-the-minute in Radio.

You can just as well have the benefit of our expert knowledge of Radio. Write for Ward's free 68 page Radio Catalogue and see the low prices.

*Our 52 Year Old Policy*

In buying Radio from Ward's you are buying from a house whose reliability is above question. For 52 years we have sold quality goods only. Address our house nearest you. Dept. No. 2-R

Headquarters for Radio

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**Montgomery Ward & Co.**

*The Oldest Mail Order House is Today the Most Progressive*

Chicago Kansas City St. Paul Portland, Ore. Oakland, Calif. Fort Worth

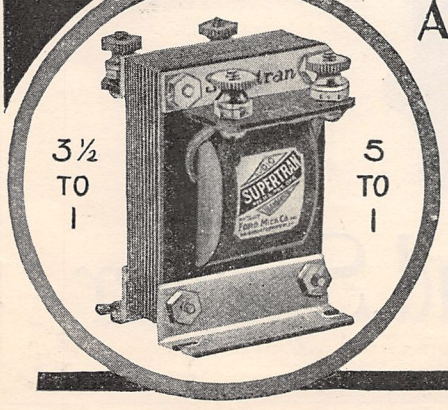
SATISFACTION GUARANTEED OR YOUR MONEY BACK

**Volume**

SUPERTRAN

Registered U. S. Patent Office

APPROVED RADIO NEWS CREATION 1922




AUDIO TRANSFORMER

If you want amplification—volume without distortion, and exactness in reproduction, use Supertran Audio Transformers. With any type of vacuum tubes Supertrans give excellent results. An exclusive feature of the Supertran is its shield assuring absolute protection against damage to the coil while mounting.

*At good dealers everywhere*
*Write for Interesting Literature*

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Waite Auto Supply Co., Providence, R. I.
The Beckley-Ralston Co., Chicago
Coast Radio Supply Co., San Francisco
Radio, Limited, Montreal, Canada.

**FORD MICA COMPANY, Inc.**
33 East 8th Street, New York

done. Having plenty of time left we hangs around for the novelty.

First they dresses the extras up as cops and has them make a grand rush at the house from the north side. Then they dolls up the same extras and has them do a swift uphill promenade as Uncle Sam's marines. Finally they're gangsters once more, and prepared to find themselves surrounded by the law, after the film editor has spliced in the other sequences. Doris and me is watching things in general when I notices a navy destroyer coming into the bay at a fast clip.

"Hey, Mr. DeFrill," I yells, "here comes some free atmosphere. Grab this ship!"

At the same time the extras, garbed as toughs, make an assault on the house from the shore slope.

Circumstances begin to happen. The destroyer has stopped, and to our surprise it lets off a broadside right over the house, the camera catching it all. Then the ship lets off a motorboat load of marines.

Then comes a screech of a siren and around a bend in the road comes half a dozen auto trucks, piled high with Los Angeles' finest. The two arms of the law alights at the same time and dashes up the hill and captures the extras. The camera has got it all, and the director is so surprised he forgets to swear. After a couple hundred feet has been shot the marines and police seem to have found that there's an Ethiopian in the lumber yard. The captain of the marines comes up to the knoll where the official staff is shooting from.

"What does this mean?" he roars.

"That's what I'd like to know," replies the director, quavering. "What are you doing here?"

"Movies!" rages the Captain. "Infernal, cheap movies!"

"Not cheap," corrects the assistant director. "We're over our cost—"

*"Cheap!"* repeats the Captain his face purple with rage. *"Who sent that radiogram?"*

"Who sent what radiogram?" falters Mr. DeFrill.

The Captain is as peaceful as the ether during Aurora Borealis season. *"What message?* Why, this call for help!"

He hands the director a yellow slip. Mr. DeFrill reads it and then gives it to me. It states:

> SOS AM BEING HELD IN STATE OF SEIGE BY CROOKS DESIRING PLANS FOR INVENTION. 500 MEN ATTACKING SPANISH CASTLE ON VANTAGE POINT. SEND HELP IMMEDIATELY. CAN NOT HOLD OUT MUCH LONGER. SOS.
>
> Prof. Ambrose Marimbo.

"Did you receive this?" I chokes.

"Where do you think I got it—in a prize contest?" bawls the Captain. *"Who sent it?"*

I feels a nudge in my back so I stays silent. For The Master is on the job.

"I beg your pardon, Captain, but what can I do for you?"

The Captain turns to Jerry like a DX fan tunes in KDKA. *"Who sent this message?"*

Jerry takes the radiogram and scans it. "Why, Captain, there must be some mistake. We didn't send this."

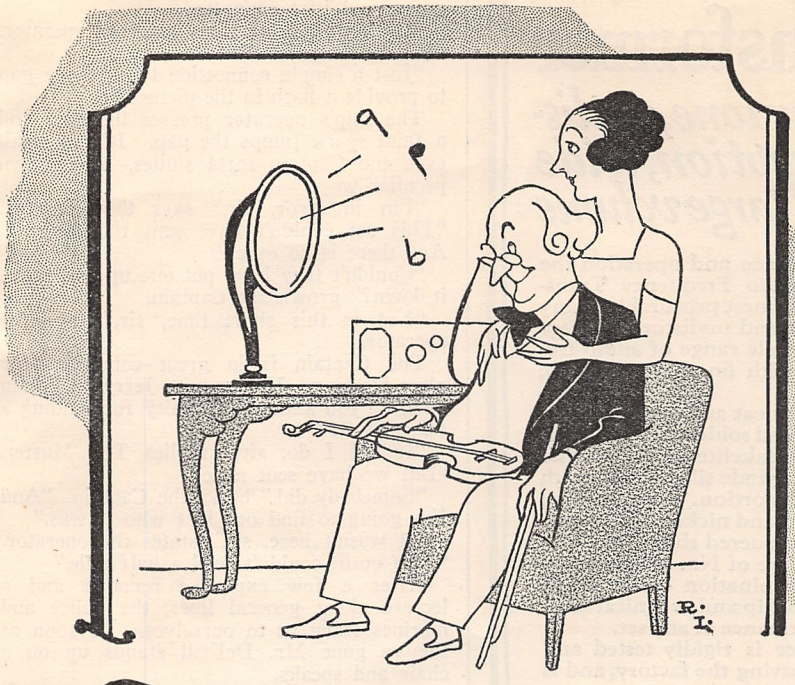
"You didn't! Maybe not. Who did?"

We're interrupted by a marine. "Beg pardon, sir, but the chief operator wishes your presence in the building immediately, sir."

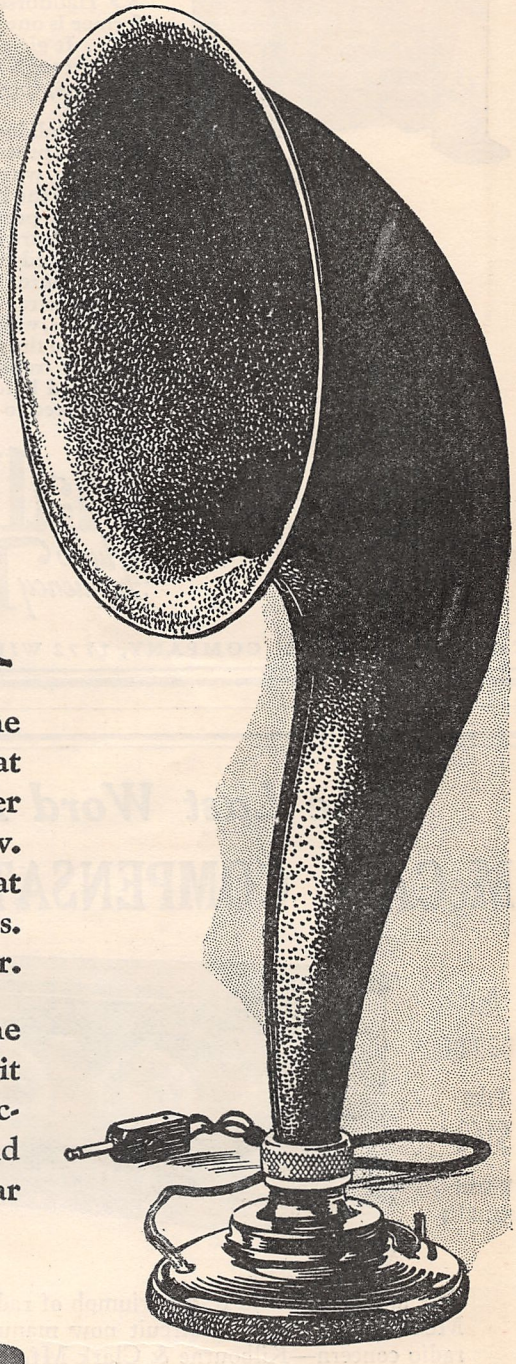
"Come along, you," orders the Captain. We come.

Into the radio room, now filled with marines and cops, we enters. At the radio set is the ship's operator.

"Here, sir, is the set that sent the message," informs the operator.



Radiola Loudspeaker
Type UZ-1325
Now $25.00



# *Music* for the critical

Time was when people were so impressed with the wonder of radio, and so entertained by the fun that came over, that they actually didn't mind the bluster of a noisy horn. But most of us aren't like that now. We want music that *is* music—we want speech that is really human speech—unclouded by horn sounds. And we can have it now—with a Radiola Loudspeaker.

You cannot blame *every* extraneous sound on the loudspeaker. But if your set is working perfectly, all it needs, to give you clear, faithful, undistorted reproduction, is a Radiola Loudspeaker. Hear one today, and if you really want to judge the difference, ask to hear it in competition with others.

# Radiola

REG. U. S. PAT. OFF.

## LOUDSPEAKER

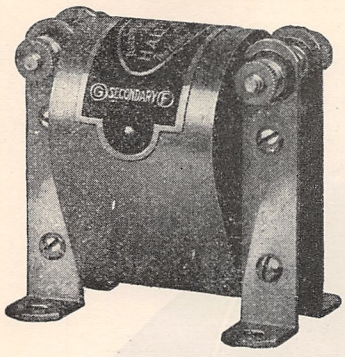
*This symbol of quality* RCA *is your protection*

RADIO CORPORATION OF AMERICA

*Sales Offices:*
233 Broadway, New York
10 So. La Salle St., Chicago, Ill.
28 Geary St., San Francisco, Cal.

# A *Guaranteed* Transformer

## *with clear tone, undistorted reception, wide range and large volume*




BOTH in appearance and operation the Halldorson Audio Frequency Transformer is one of the finest procurable at any price. It gives clear and undistorted reception through the whole range of audio frequencies, together with fine tone and large volume.

The Halldorson is neat and compact. The leads are protected and soldered to the binding posts, which are Bakelite insulated. The core is of the highest grade silicon steel, with air gaps to prevent distortion. The mounting standards are rugged and nickeled. The core is protected by a lacquered shield of phosphor bronze. Coils are of No. 40 enameled copper wire. A combination of the finest materials, workmanship and technical skill. It adds to the performance of any set.

Every transformer is rigidly tested and inspected before leaving the factory, and is guaranteed to give satisfaction.

**Price**

Ratio 4:1 $4.00
Ratio 2:1 $4.75
Ratio 6:1 $4.50

*Write for literature*

**Halldorson** *Audio Frequency* **Transformer**

THE HALLDORSON COMPANY, 1772 WILSON AVENUE, CHICAGO



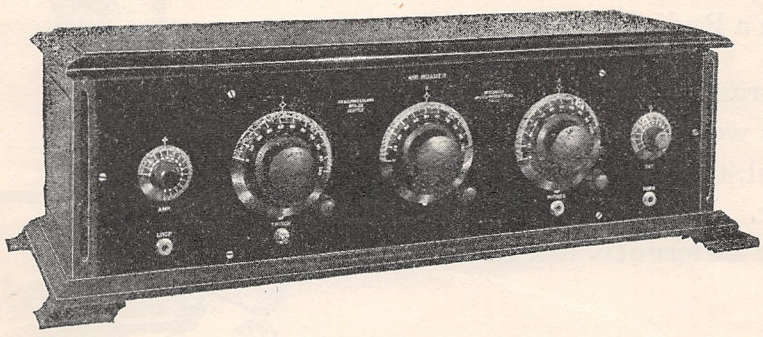
## *The Last Word In Radio*

# McCALL COMPENSATED CIRCUIT

**Air Roamer**

**Price $140**

**Without Accessories**



The latest, tried and tested triumph of radio engineering—the new McCall Compensated Circuit now manufactured by the pioneer radio concern—Kilbourne & Clark Mfg. Co.

HERE ARE THE POINTS OF SUPERIORITY:

1. Unusual Selectivity.
2. Quality of Reproduction.
3. Great Volume.
4. Logs Accurately.

*Send to nearest office for full details.*

**KILBOURNE & CLARK MFG. CO., Seattle**

Branches: 1103 W. 10th St., Los Angeles
171 Second St., San Francisco
53 Fourth St., Portland, Ore.
Australian Distributors, Pacific Electric Co., Sydney


"But it couldn't have," insists Jerry. "It's only a dummy outfit, used for picture purposes, and isn't connected."

"Oh, isn't it?" puts in the ship's operator. "What's this wire?"

"Just a simple connection to a rotary gap to provide a flash in the picture."

The ship's operator presses the key, and a faint spark jumps the gap. It's so weak even the Captain sorta smiles, in his own peculiar way.

"I'm in error, sir," says the operator. "This set couldn't have sent the message. And there is no other."

"Couldn't they have put one up and taken it down?" growls the Captain.

"Not in this short time, sir," says the operator.

The Captain is in great condition—for glass blowing. He turns to Jerry. "Young man, do you know the penalty for sending a false SOS?"

"Indeed I do, sir," replies The Master. "But we have sent none."

"Somebody did," barks the Captain. "And I'm going to find out just who it was."

"It wasn't here, sir," states the operator. "This outfit couldn't send a half mile."

After a few explosive remarks and a lecture along general lines, the police and marines leave us to ourselves. As soon as they're gone Mr. DeFrill stands up on a chair and speaks.

"I propose three cheers for Mr. Lawson," he says. Three cheers are given with a will.

"Mr. Lawson, you have proven a most invaluable aid," says the director. "The mob scenes effected by the coming of the police and navy have put our picture amongst the highest in their class. To you we owe our thanks."

"Thanks?" mutters Jerry. "What for?"

"Come, come," laughs Mr. DeFrill. "We know all about that message. Clever, I call it."

Jerry is surprised. "Why, gentlemen, I had nothing to do with that radiogram. I assure you—"

"Haw, haw, haw!" laughs the director. "Isn't he modest, though?"

The wife butts in. "Gosh, Joe, it's one-thirty. We'd better make tracks for the theatre."

"I'll drive you back," offers Jerry, sort of stupid-like.

Nothing is said for a few minutes. Then I speaks.

"I gotta compliment you, Jerry," I offers. "You put that over neat."

"Put what over neat?"

"Why, that story about its not being connected."

"But, Joe, it wasn't."

Limits is limits. "See here, Jerry, you're among friends. How'd you come to think of it?"

"But I didn't—" Wham! On goes the brakes and The Master turns around and faces us.

"Joe, explain yourself. You seem to know something about that message. I don't understand."

Having known Jerry's peculiarities for some time, I complies with his request. "Why, that message he handed me was the very one I sent."

"But it couldn't have been, Joe—"

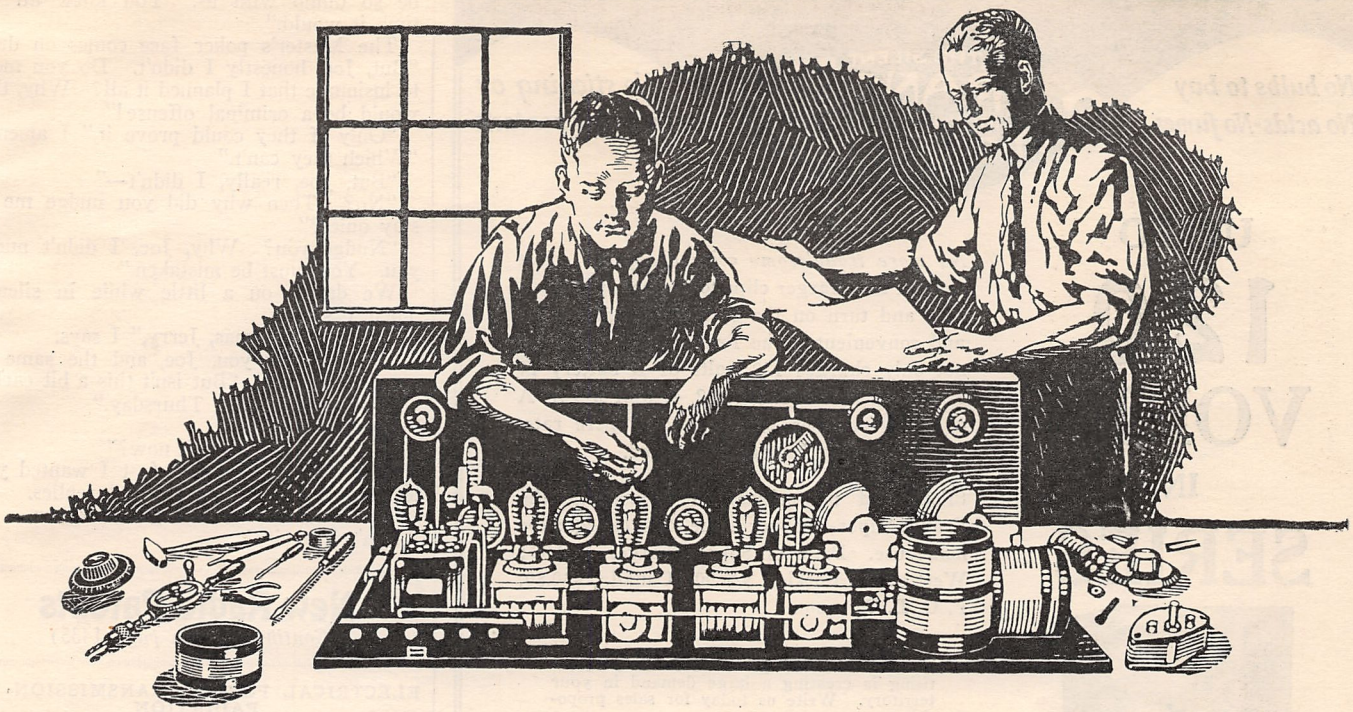
"Say, listen! Don't you remember hooking in that 10 k.w. transformer to get a heavier spark?"

"Yes, but I immediately disconnected it—OH!"

"OH!" I snickers. "And you didn't know it all the time, either, did you? OH, no!"

"Why," stutters Jerry, "a 10 k.w. transformer would send a message 20 miles without any other connection than the gap, wouldn't it?"

"Wouldn't it!" I laughs. "Jerry, don't



# The men who know say "Use Formica"

ONE hundred and twenty-five of the leading radio manufacturers of America by their example tell you to use Formica as the panel and tube material in the set you are building. They use it themselves — because they know it to be the most uniform, best looking, most satisfactory form of Bakelite.

The bigger the panel you use and the more apparatus you mount on it the more important it is to use Formica. For Formica will not sag, warp or get out of shape — it has the strength to give you years of perfect service.

This year, scores of manufacturers will use Formica base panels, and Formica terminal strips. They stop electrical losses and greatly increase the efficiency of a set.

There is no question as to which is the best radio insulating material—and you want the best. Four beautiful finishes: Gloss black, flat black, mahogany and walnut.

*Dealers:* For the big Neutrodyne and super-hetrodyne panels, Formica is practically a necessity. Formica will sell stronger than ever this year.

THE FORMICA INSULATION COMPANY
4618 Spring Grove Avenue, Cincinnati, Ohio

Hear the Formica Band every Wednesday evening from 9 to 10, Central Time, over WLW.

APPROVED RADIO NEWS LABORATORIES 1925

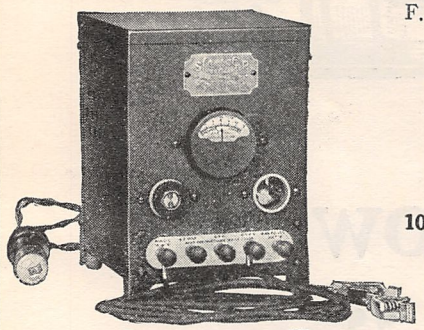
**FORMICA**
Made from Anhydrous Bakelite Resins
SHEETS TUBES RODS

*No bulbs to buy*
*No acids-No fumes*

THE SILENT FRANCE MULTI-DUTY SUPER-CHARGER

*No sticking or sparking contacts*

UP TO
120
VOLTS
IN
SERIES



*No more troublesome wire changing!* Just connect the charger clips to the battery terminals and turn on the current—simple, quick and convenient. The France Super-Charger not only charges 120 volts of B battery *in series* but it also charges 2, 4, 6 or 8 volt A or Auto batteries, at a 5 to 7 ampere rate, tapering as the battery is charged.

Silent and non-critical in adjustment the France Super-Charger is the ideal charger for home use. Price of Super-Charger, $22.00; West of the Rockies, $23.00; Canada, $30.80, F. O. B. Toronto.

DEALERS AND JOBBERS—This advertising is creating a large demand in your territory. Write us today for sales proposition.

THE FRANCE MFG. CO.
10320 Berea Rd., Cleveland, Ohio

Stocks carried at convenient points throughout the United States and Canada.

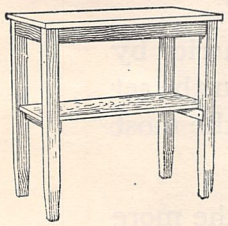
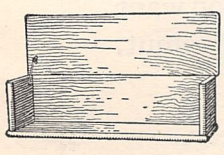


TABLE NO. 31

Substantial table 15"x31" x29". Packed 1 each in carton .....$3.50



SPECIFICATIONS AND PRICES

| | |
|---|---|
| Panl 7x 9" 7" deep | $1.80 |
| Panel 7x12" 7" deep | 2.00 |
| Panel 7x14" 7" deep | 2.25 |
| Panel 7x16" 7" deep | 2.30 |
| Panel 7x18" 7" deep | 2.40 |
| Panel 7x21" 7" deep | 2.50 |
| Panel 7x24" 7" deep | 2.60 |
| Panel 7x26" 7" deep | 2.70 |
| Panel 7x28" 7" deep | 2.80 |
| Panel 7x30" 7" deep | 3.25 |
| Panel 7x36" 7" deep | 4.75 |
| Panel 7x40" 7" deep | 5.25 |
| Panel 8x40" 8" deep | 5.75 |
| 8 or 9" panels add | 30% |
| 8 or 9" deep add | 30% |

MBG RADIO CABINETS

*For your* RADIO SET

Get an MBG Cabinet for your set today. Any size you need at ridiculously low prices. All our cabinets are strongly made from beautifully grained Douglas Fir. Shipped in the natural wood with full instructions for staining at home to harmonize with 24 standard wood finishes. Make your radio set an attractive piece of furniture at low cost.

Radio Cabinet Department
Express Body Corporation
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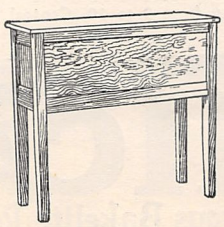
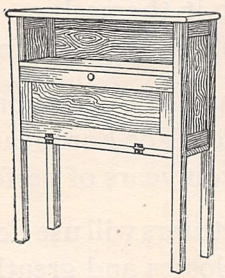
CABINET NO. 29

Battery compartment 10" x 11" x 29" open back with shelf compartment for B Battery. Panel front to conceal batteries, over all measurements 11½" x 32 x 29". Set up complete in carton, $7.50.





CONSOLE CABINET No. 37

| Panel Size | Dep | Bat.Comp. | Price |
|---|---|---|---|
| 7x18" | 9" | 10x11x18" | $10.50 |
| 7x24" | 9" | 10x11x24" | 11.50 |
| 7x26" | 9" | 10x11x26" | 11.50 |
| 7x28" | 9" | 10x11x28" | 11.50 |

Additional door makes shelf in front of panel when open, extra ..$3.00

No. 37 two-door console for 5 tube Atwater-Kent set

| Panel Size | Depth | Bat. Comp. |
|---|---|---|
| 8x30" | 10½" | 10x11x30" |

Price $17.50

To fit 6-tube Atwater-Kent

| Panel Size | Depth | Bat. Comp. |
|---|---|---|
| 8x36" | 10½" | 10x11x36" |

Price $20.50

Mounting boards, each 50c Shipped set up complete, one to a carton.

Get a Handy Binder for your RADIO NEWS. Holds and preserves six issues, each of which can be inserted or removed at will. Price 65c. Experimenter Pub. Co., Inc., Book Dept., 53 Park Place, N. Y.

be so dumb with us. You knew all the time it would."

The Master's poker face comes on duty. "But, Joe, honestly I didn't. Do you mean to insinuate that I planned it all? Why, that would be a criminal offense!"

"Only if they could prove it," I amends. "Which they can't."

"But, Joe, really, I didn't—"

"No? Then why did you nudge me to stay quiet?"

"Nudge you? Why, Joe, I didn't nudge you. You must be mistaken."

We drives on a little while in silence. Then I speaks.

"Merry Christmas, Jerry," I says.

"Why, thank you, Joe, and the same to you," he replies. "But isn't this a bit early? Christmas isn't until Thursday."

"I know it."

"Then why wish me it now?"

"Because you work so fast I wanted you to be sure to get it in time," I replies.

The Master never did get that one.

Ain't it a pity?

## New Radio Patents

(*Continued from page* 1435)

### ELECTRICAL POWER TRANSMISSION BY RADIATION

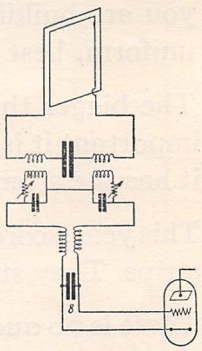
(Patent No. 1,510,624, A. J. Kloneck. Filed March 31, 1920. Issued Oct. 7, 1924.)

Electrical power transmission by radiation for the purposes of driving machinery at distant points from one or more central power stations. The patent describes a system for transmitting and receiving light and motor power, comprising a plurality of independently operating generating dynamos arranged at remote points from one another and adapted for co-operatively radiating electrical energy of one character and of a frequency below 200 cycles. Independent radiating circuits are provided for the separate dynamos and each of the radiating circuits are tuned to a corresponding frequency.

### DOUBLY TUNED RADIO RECEIVERS

(Patent No. 1,507,725, J. Bethenod, et al. Filed Aug. 19, 1921. Issued Sept. 9, 1924.)

Doubly tuned radio receiver including one circuit tuned to a frequency greater than the signal frequency, and a second circuit tuned to a frequency lower than the signal frequency. The circuits are so arranged that the currents therein may be opposed to prevent the response of the system to sudden discharges such as static, but to permit the system to operate on the receipt of signals.



### RECEIVING CIRCUIT FOR THE ELIMINATION OF STATIC DISTURBANCES

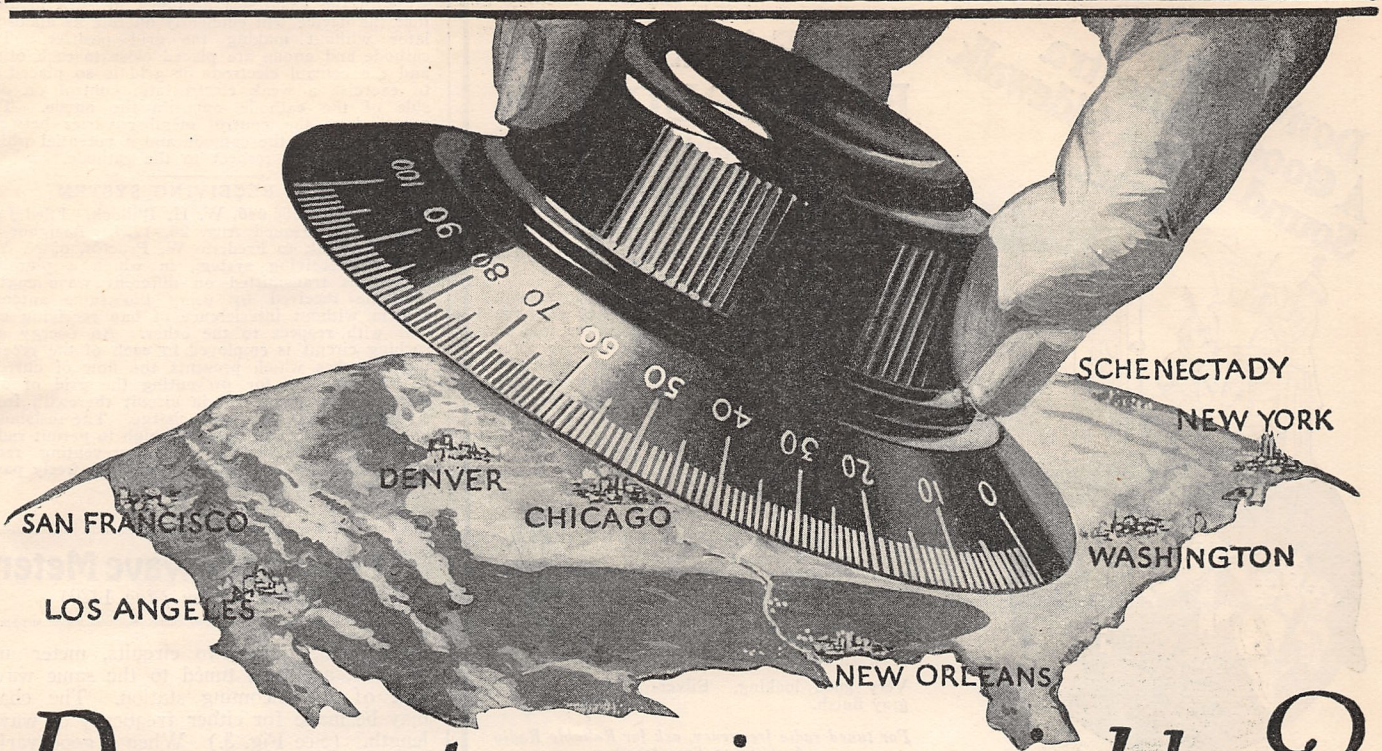
(Patent No. 1,513,223, F. Conrad. Filed Oct. 17, 1918. Issued Oct. 28, 1924.)

Receiving circuit for the elimination of static disturbances, employing two antennae associated with the receiving apparatus in such manner that substantially equal charges imparted thereto by static influences cancel each other within the receiving apparatus, thus being rendered imperceptible to the operator. The antennae are supported at different heights so that the signal impulses will be stronger in one antenna than in the other. The unequal amounts of energy imparted to the antenna by incoming signal impulses fail to cancel each other and thus a residual effect is imparted in the receiving apparatus which may be amplified if desirable in order to render it more clearly perceptible to the operator.

### ELECTRIC OSCILLATOR

(Patent No. 1,506,486, A. W. Hull. Filed Mar. 1, 1920. Issued Aug. 26, 1924. Assigned to General Electric Co., of New York.)

Electric oscillator including an evacuated ves-




# *Do you tune-in quickly?*

## What a difference a good dial makes

THERE are dials and dials and there's a big difference in them. Some are much easier to read than others. The hand seems to fit the knobs of some exactly. Enjoy the pleasure and comfort of tuning in with greater ease and speed than ever before. Use Na-Ald Super De Luxe Dials and experience real dial satisfaction.

Station after station can be tuned in quickly and comfortably. Even if you tune in over and over again, searching for distant stations until late into the evening, you will experience no eyestrain, nor finger-cramps when you turn the big generous-sized knob. It fits your fingers naturally.

It took engineers and optical experts months of careful study to perfect the scientific design of Na-Ald Dials. Stop Watch tests developed the best possible position of numbers, and lengths, spacing and width of lines.

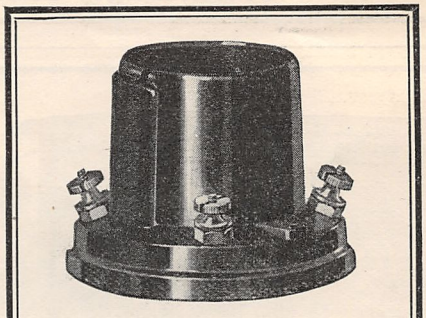
You can obtain Na-Ald Dials at radio, electrical and hardware stores. Use them not only in the set you build but also install them in the set you buy, if not already adopted by the manufacturer. Super-De Luxe 75c; other sizes 35c, and 50c.

Send for free copy of radio booklet—"What to Build," showing a number of the best tested and selected circuits.

ALDEN MANUFACTURING COMPANY

*Also makers of the famous Na-Ald Sockets*

Dept. K-3, Springfield, Mass.



Na-Ald also manufactures a complete line of Bakelite Sockets for all tubes. De Luxe with special clean-easy feature, 75c; others 35c, 50c, 75c.

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Sockets and Dials

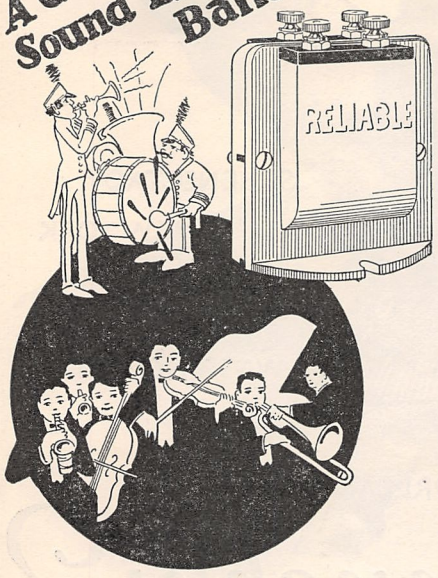
ALDEN MANUFACTURING COMPANY
Dept. K-3, Willow Street, Springfield, Mass.

Please send free copy of booklet "What to Build," showing tested and selected circuits.

*Name* .....

*Address* .....

*City* ..... *State* .....

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### Audio Frequency Amplifying Transformers

Although radio is largely entertainment through our sense of hearing, it is possible to visualize concerts so that one can almost *see* as well as *hear* what is going on. Don't deceive your imagination by mistaking high class orchestras to be brass bands, talented tenors for amateur warblers, violin solos for scratchy discords, and so on.

Get realistic reproduction with the Reliable Audio Frequency Transformers whether it be from local stations or a trans-continental program.

These transformers give faithful, clear, well-toned sound reproduction and positively eliminate leakage of magnetic flux, confining eddy currents. Accuracy and uniformity of primary and secondary windings, an important feature.

Very good looking. Silver-gray finish.

*For tuned radio frequency, ask for Reliable Radio Amplifying Transformers*

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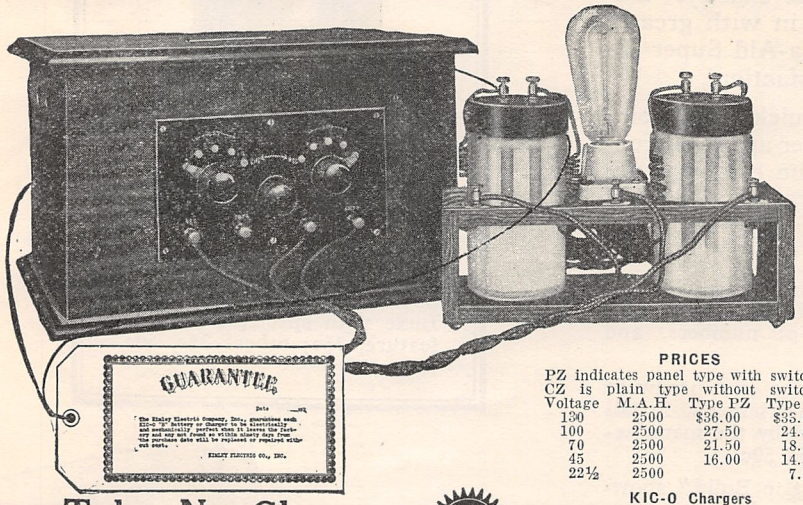
**2819 Prospect Avenue** **Cleveland, O.**

We also manufacture Reliable Micro-Air Condensers, Battery Fillers, Battery Testers, etc.






## You Take No Chances with KIC-O Batteries

This storage battery supreme is now serving radio fans all over the country. It is giving clearer reception, and avoiding the annoying difficulties so often met with in the use of inferior batteries. KIC-O "B" Storage Batteries give an even, dependable discharge over long periods of service. They are not harmed by standing idle or by over-charging. Nickel-zinc elements, including in their composition liberal proportions of iron and nickel, preserved by a special alkaline solution, give KIC-O "B" Batteries practically unlimited life.

With KIC-O Double and Single Cell Chargers you recharge your "B" Batteries at a small cost from any regular 110 volt A.C. lighting line.

Let KIC-O Equipment end your radio "B" Battery troubles—NOW.

**KIMLEY ELECTRIC CO., Inc.**

**2665 MAIN STREET BUFFALO, N. Y.**

**PRICES**

PZ indicates panel type with switches. CZ is plain type without switches.

| Voltage | M.A.H. | Type PZ | Type CZ |
|---|---|---|---|
| 130 | 2500 | $36.00 | $33.00 |
| 100 | 2500 | 27.50 | 24.50 |
| 70 | 2500 | 21.50 | 18.50 |
| 45 | 2500 | 16.00 | 14.50 |
| 22½ | 2500 | | 7.50 |

**KIC-O Chargers**

Type K-1 Single unmounted .... $1.50
Type K-2 Single mounted ..... 3.50
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KIC-O Special Charger Chemicals .75

The use of KIC-O Batteries and Chargers is the best Radio economy you can practice. Get full information today—or better still, use the coupon and have us send the proper size Battery and Charger subject to our iron clad satisfaction guarantee.

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Gentlemen:

Please send items checked below to undersigned address:

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Voltage..... Price.....

KIC-O Charger (specify which)

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Full information regarding KIC-O equipment.

Send C. O. D. subject to guarantee of satisfaction or money back to

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sel with the electrodes arranged in such manner that the device will efficiently operate as an oscillator without making the grid positive. The cathode and anode are placed close to each other and the control electrode or grid is so placed as to exercise a weak electrostatic control on one side of the cathode opposite the anode. The potential of the control member varies between the potential of the cathode and a potential which is negative with respect to the cathode.

### RADIO RECEIVING SYSTEM

(Patent No. 1,506,046, W. H. Bullock. Filed Jan. 23, 1923. Issued Aug. 26, 1924. Assignor of 49 per cent. to Frederic W. Proctor, of N. Y.)

Radio receiving system, in which a plurality of signals transmitted on different wave-lengths may be received by using the same antenna system without interference of one receiving circuit with respect to the other. An energy absorbing circuit is employed in each of the receiving branches which prevents the flow of current in one direction for preventing the grid of one electron tube connected in circuit therewith from acquiring a static negative charge. The resistance of the absorbing circuit is too high to permit radio frequency oscillations, thereby preventing reaction of one circuit upon another while freely passing the desired signal frequency.

## A Frequency-Wave Meter

(*Continued from page* 1420)

the station. The two circuits, meter and receiver, are then tuned to the same wave, that of the incoming station. The chart may be made for either frequency or wave-length. (See Fig. 3.) When a good variable condenser is had, the manufacturer will supply a wave-length chart for the full range of the dial.

An aid in the adjustment of the dial would be an anti-capacity handle six or eight inches long. Bakelite rod is good, but pretty costly. The author has a long hard rubber cigarette holder which is threaded at the small end and fits into a tapped hole in the dial. The hole in the holder is filled with paraffin to make the rod stiffer. The handle is a great help when adjusting for the wave reading of a transmitter. The handle is easily removed when the instrument is to be carried about.

There are other uses to which a meter of this type may be put, such as a wave trap or a tuned radio frequency choke. When coupled closely to the secondary coil of a tuner it will act as the fourth circuit in the much used four circuit tuner. An experimenter may find a dozen purposes for it in doing test work. The writer would appreciate any comments on the frequency wave meter and will answer all correspondence in reference to it. Address him at 113 Pine Grove Ave., Pontiac, Mich.

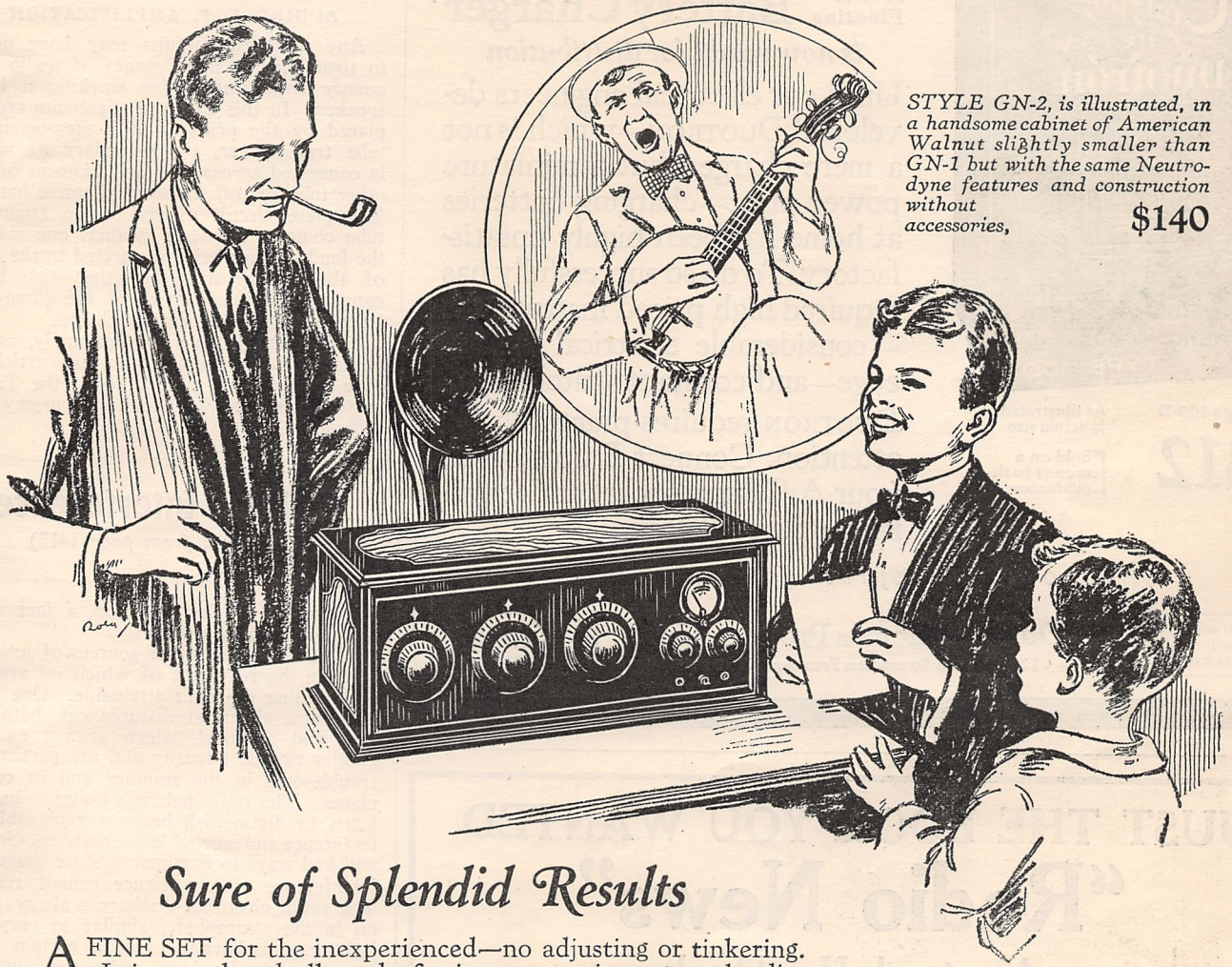
## Multi-Stage Radio Frequency Amplification

(*Continued from page* 1409)

usual method will be to apply the regeneration from the detector tube to the grid circuit of the first tube, and Fig. 9 shows how this may be accomplished in a simple three-tube set. It will be seen that the regeneration coil $L_3$ is coupled to the grid coil $L_1$, and this regeneration effect is communicated, of course, not only to the aerial circuit but also to the tuned plate circuit $L_2$ $C_2$, any adjustment of the coupling between $L_3$ and $L_1$ being accompanied by a retuning on $C_1$ and $C_2$. This circuit is the best one for the beginner to try. The size of the choke coil Z will depend, of course, on the wave-length about to be received, and may also depend upon the capacity of the first tube. Generally, however, a 200 or 250 honeycomb coil will be found useful for this purpose when receiving the ordinary broadcast stations on the 300 to 500 meter wave band. The choke coil Z may be replaced by a resistance $R_6$ when longer wave-lengths are

# GILFILLAN NEUTRODYNE

*"Far and Near—Equally Clear"*



*STYLE GN-2, is illustrated, in a handsome cabinet of American Walnut slightly smaller than GN-1 but with the same Neutrodyne features and construction without accessories,* **$140**

## *Sure of Splendid Results*

A FINE SET for the inexperienced—no adjusting or tinkering. It is tested and all ready for instant service to get the distant station or to select a particular station with a wave length nearly the same as others. No matter how many stations are playing you can "reach out" and bring in what you want—with clear, full tone and without interference or distortion. Stations once recorded, come in at the same dialing thereafter.

These sets are made in our three Radio factories with years of Radio experience behind them, to supply the Radio trade of any locality. Superior in Range, Selectivity, Clarity and Volume, the Gilfillan Neutrodyne will be as good 10 years from now as today. It has unique ability and power to bring in only what you want to hear—no matter how far or near.

Young and old will be delighted and thoroughly satisfied with the operation, Power, Selectivity and Clarity of the Gilfillan Neutrodyne.

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*STYLE GN-1*
*In a handsome two-tone American Walnut cabinet (with space for "A" Batteries) harmonizing with any interior. Price without accessories . .* **$175**

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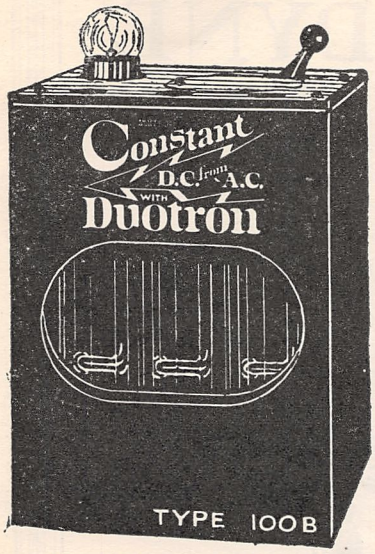
Pat. Mar. 27, 1923 and April 4, 1924
Hazeltine Pats. Nos. 1,450,080 - 1,489,228
Other Patents Pending

*Here is a miniature power plant to supply your Radio Batteries—*




# Duotron

A & B Floating **Battery Charger**

*is now ready for distribution*

Until our electrical engineers developed DUOTRON—which is not a mere charger, but a miniature power plant—charging batteries at home has been highly unsatisfactory. To do so successfully has required high priced instruments—considerable electrical knowledge—and constant watching.

DUOTRON requires practically no attention. Connect DUOTRON to your A-C lamp socket and it will keep up any Battery.

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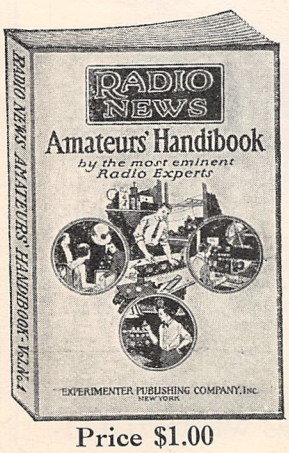


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to be received. The resistance $R_6$ is shown in dotted lines to indicate that it may replace the choke coil Z in the circuit. The value of the resistance $R_6$ may conveniently be 100,000 ohms, although as low a value as 50,000 ohms may be employed.

Fig. 10 shows a modified arrangement in which regeneration is introduced, not from end to end, but from the last tube to the last tuned plate circuit $L_2$ $C_2$. A resistance $R_6$ is shown connected in the plate circuit of the first tube, but for short wave-lengths the choke coil Z shown in dotted lines may replace $R_6$.

### ADDING A. F. AMPLIFICATION

Any of these circuits may have added to them one or more stages of audio frequency amplification for working a loudspeaker. In this case the telephones are replaced by the primary of a step-up intertube transformer, the secondary of which is connected across grid and filament of another tube fed off the same filament battery. The plate circuit of this audio frequency tube contains the loud speaker, one side of the loud speaker being connected to the plate of the battery and the other side being connected to the positive of the same "B" battery used in the circuit chosen.

The ordinary general rules apply, and it is not thought necessary in this article to give examples of circuits using the T.A.T. system combined with audio frequency amplification.

## Fighting Interference

(*Continued from page* 1415)

improvement in that direction, a fact which is not commonly realized.

"There are also other sources of interference, in the reduction of which we are fast approaching the limit attainable. One is atmospheric electrical disturbances, both natural and artificial, which always exist in greater or less intensity and are particularly troublesome in the summer and in certain places. The radio public is going to have to learn to distinguish between removable interference and inevitable interference. Science will find ways to circumvent those sources of interference which science cannot remove. The slight electrical discharges always going on in the atmosphere, similar to very tiny lightning discharges, cause a certain background of noise in a radio receiving set, and these discharges can probably never be prevented any more than variations of weather can be prevented. They are a sort of natural limit to what a receiving set can do, for if the waves from a distant station are weaker than the average of these atmospheric disturbances, no increase of amplification in the receiving set can bring in the distant station without the interference.

"For the growing radio public, which demands real service and quality in the radio programs, this situation means that there are definite limits to the distance from a broadcast station at which satisfactory reception is possible. To increase that distance, higher power must be used in the broadcast stations. This is now recognized, and there will be increases in the power of many of the stations. Considerable fear had been expressed that the use of high power, while of obvious benefit to the farmers and others remote from the stations, would make it harder for city dwellers to tune out the nearest station when they wished to receive others. This fear will not be realized if the stations of higher and higher power are located farther and farther away from centers of population. Reception conditions then will be better for city dwellers than at present, when the principal stations are located in the very midst of the cities.

# MURDOCK NEUTRODYNE

## $100
## *with built-in Loudspeaker*

THE Murdock Five Tube Neutrodyne is the outstanding 1925 model receiving set. You will be impressed by the beautiful tone quality and the rich cabinet design. There is space in the cabinet for "B" batteries and the only accessories necessary are batteries and tubes. A "Murdock" set is backed by our 20 years of successful experience in making radio apparatus.

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# MURDOCK RADIO PRODUCTS

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RADIO MURDOCK

Licensed by Independent Radio Manufacturers, Inc. NEUTRODYNE Reg. U.S. Pat. Off. Pat. March 27 1923 and April 1, 1924 Hazeltine Pats. Nos. 1,450,080 and 1,489,228 Other Patents Pending.

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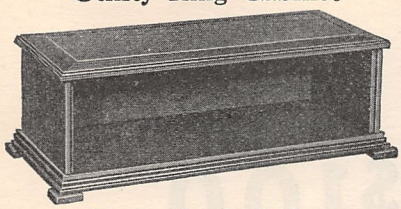
High Grade Radio Cabinets, sturdy built and fine looking. Built from select genuine black walnut or birch. Elegantly finished. Tops on all cabinets hinged. Fronts of cabinets are rabbeted to take panel. Walnut cabinets have continuous piano hinges and lid holders. Birch cabinets have regular hinges. (No lid holders.) Walnut cabinets finished in French walnut. Birch cabinets finished in Adam brown mahogany. (Panels not included). Money back if not satisfied.

**Utility King Cabinet**



**Surely a Dandy Cabinet**

| | No. | For Panel | Deep, in. | Birch | Walnut |
|---|---|---|---|---|---|
| King | 610½ | 6x10½ | 7 | $3.35 | $ 5.35 |
| King | 614 | 6x14 | 7 | 3.85 | 6.20 |
| King | 621 | 6x21 | 7 | 4.60 | 6.80 |
| King | 712 | 7x12 | 7 | 4.00 | 6.50 |
| King | 714 | 7x14 | 7 | 4.20 | 6.70 |
| King | 718 | 7x18 | 7 | 4.35 | 6.80 |
| King | 721 | 7x21 | 7 | 4.90 | 7.40 |
| King | 724 | 7x24 | 7 | 5.35 | 8.00 |
| King | 726 | 7x26 | 7 | 5.80 | 8.50 |
| King | 727 | 7x27 | 7 | 6.20 | 9.00 |
| King | 728 | 7x28 | 7 | 6.60 | 10.00 |
| King | 730 | 7x30 | 7 | 7.00 | 11.00 |
| King | 72410 | 7x24 | 10 | 6.70 | 10.00 |
| King | 72610 | 7x26 | 10 | 7.25 | 10.50 |
| King | 72710 | 7x27 | 10 | 7.70 | 11.50 |
| King | 72810 | 7x28 | 10 | 8.00 | 12.00 |
| King | 73010 | 7x30 | 10 | 8.20 | 12.50 |
| King | 840 | 8x40 | 8 | 9.25 | 12.50 |
| King | 914 | 9x14 | 10 | 5.25 | 7.00 |
| King | 921 | 9x21 | 10 | 7.50 | 9.25 |
| King | 924 | 9x24 | 10 | 8.50 | 10.50 |
| King | 1214 | 12x14 | 10 | 5.50 | 8.00 |
| King | 1221 | 12x21 | 10 | 7.25 | 10.50 |

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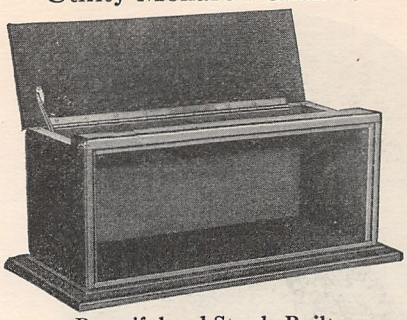

**Beautiful and Sturdy Built**

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|---|---|---|---|---|
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| K 614 | 6x14 | 7 | 3.85 | 6.20 |
| K 621 | 6x21 | 7 | 4.60 | 6.80 |
| K 712 | 7x12 | 7 | 4.00 | 6.50 |
| K 714 | 7x14 | 7 | 4.20 | 6.70 |
| K 718 | 7x18 | 7 | 4.35 | 6.80 |
| K 721 | 7x21 | 7 | 4.90 | 7.40 |
| K 724 | 7x24 | 7 | 5.35 | 8.00 |
| K 726 | 7x26 | 7 | 5.80 | 8.50 |
| K 727 | 7x27 | 7 | 6.20 | 9.00 |
| K 728 | 7x28 | 7 | 6.60 | 10.00 |
| K 730 | 7x30 | 7 | 7.00 | 11.00 |
| K72410 | 7x24 | 10 | 6.70 | 10.00 |
| K72610 | 7x26 | 10 | 7.25 | 10.50 |
| K72710 | 7x27 | 10 | 7.70 | 11.50 |
| K72810 | 7x28 | 10 | 8.00 | 12.00 |
| K73010 | 7x30 | 10 | 8.20 | 12.50 |
| K 840 | 8x40 | 8 | 9.25 | 12.50 |
| K 914 | 9x14 | 10 | 5.25 | 7.00 |
| K 921 | 9x21 | 10 | 7.50 | 9.25 |
| K 924 | 9x24 | 10 | 8.50 | 10.50 |
| K 1214 | 12x14 | 10 | 5.50 | 8.00 |
| K 1221 | 12x21 | 10 | 7.25 | 10.50 |

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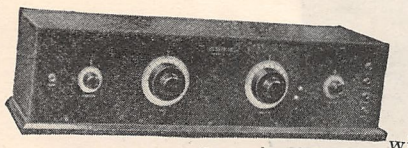

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"To deal effectively with the various sources of interference, it is important that there be exact knowledge of their prevalence. Some information of this kind is available as a result of observations carried on by the Bureau of Standards during the past two years with the co-operation of about 200 voluntary observers, located up to 400 miles from two selected broadcast stations. Preliminary results show the following averages for all observers: First, no interference 23 per cent. of the times when reception was attempted; interference from other broadcast stations, 32 per cent.; atmospheric disturbances, 18 per cent.; fading or irregular variation of intensity of received signal, 13 per cent.; amateur transmitting stations, 6 per cent.; radiating receiving sets, 5 per cent.; commercial radio telegraph stations, 2 per cent.; and non-radio electrical interference, 1 per cent. More complete results will show decreases in the percentages for the causes under the control of man, and corresponding increases in the percentages from atmospheric disturbances and fading. The man-made interference of the various types is of local character, some types of it being confined to very small areas around the source.

"The source of largest interference, that from other broadcast stations, will soon be still further reduced as a result of the new assignments of wave-lengths made by the conference. The broadcast stations are distributed through a somewhat wider range of frequencies, and the removal of ship radio communications from the broadcast range. Broadcast stations in different localities are kept from interfering by working on different frequencies. Some interference results from slight variations from the assigned frequencies, but there is marked improvement in the accuracy with which these frequencies are held.

"Interference from amateurs and commercial radio telegraph stations has been steadily decreasing, partly because of closer attention to staying within the assigned frequencies, and partly because of rapidly increasing use of the continuous-wave system, which produces much less interference than the old spark apparatus.

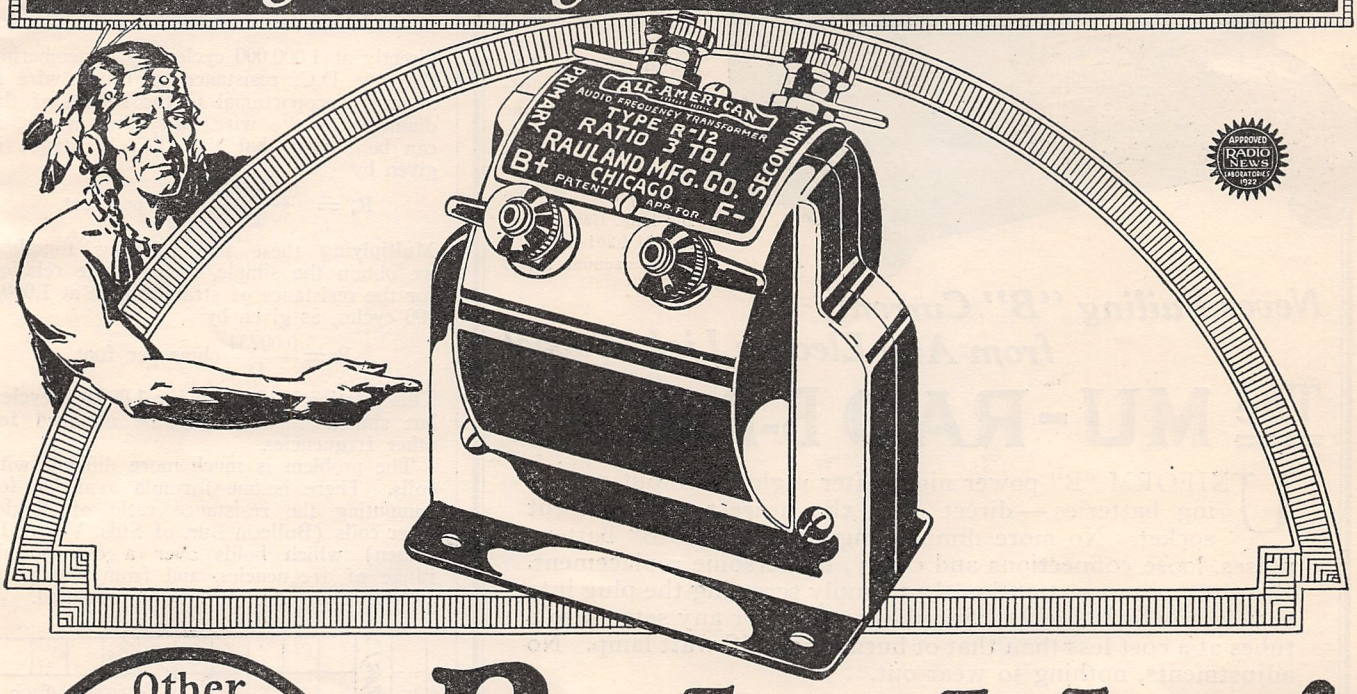
"Interference from radiating receiving sets is growing less of a problem than it was. Manufacturers are more inclined to limit their efforts to sell radiating sets to the rural districts where such sets cause no trouble. The listeners are learning how to operate regenerative and super-heterodyne sets so as to produce little or no radiation. As a result, interference of this type is now largely confined to congested city districts, particularly in apartment and row houses, in the reception of distant stations. Progress in receiving set design will continue to reduce this annoyance.

"A campaign is now on to reduce interference from non-radio electrical apparatus. Such interference arises from electric power lines, faulty insulators, violet-ray machines, sparking commutators, and sometimes from domestic devices. Means of reducing such interference by shunting condensers, electrical filters, etc., either at the source of interference or at the receiving set, are being worked out. Some of these electrical causes of interference are, like atmospheric disturbances, part of the omnipresent background of slight electrical discharges which necessarily drown out signals below a certain intensity and set a definite limit on reception from distant stations."

## NOTICE TO RADIO CLUBS

RADIO NEWS is engaged in compiling a list of all the radio clubs in the United States and Canada. To get out a complete and comprehensive list requires the co-operation of RADIO NEWS' readers who are members of radio clubs. We will appreciate very much your sending to RADIO NEWS the name and address of the club to which you belong and if possible the name of the secretary or some official to whom correspondence may be addressed.

# The Largest Selling Transformers in the World




# Reliable!

ALL-AMERICAN Standard Audio Frequency Transformers in any radio receiving set mean but one thing—*assured* efficiency in amplification. Since 1919 ALL-AMERICAN Audios have answered the demand for an instrument that could be *relied* upon for maximum amplification and faithful tone reproduction. Set builders who know radio do not experiment—they specify ALL-AMERICANS, with full assurance that they will consistently perform with highest efficiency.

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ALL-AMERICAN reliability is a natural result of ALL-AMERICAN *precision manufacture*. Each part is scientifically designed and accurately built to exact standards. Special machinery and testing equipment assist in achieving perfection.

When you are buying a new set, look under the lid for ALL-AMERICAN Audios. Or install ALL-AMERICANS in your present set if it is not already equipped with them. You'll appreciate the difference in amplification. 3 to 1 Ratio, $4.50. 5 to 1 Ratio, $4.75. 10 to 1 Ratio, $4.75.

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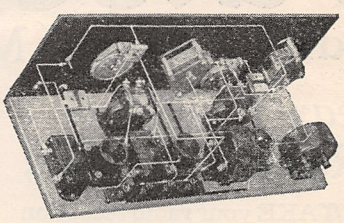

Complete receiving sets, with all instruments mounted on panel and baseboard ready to be wired. Clear photographs, blueprints and a 48-page instruction book make wiring so easy as to be the work of only one delightful evening.

All-Amax Junior is a one-tube set with remarkable selectivity and volume. It tunes out the locals and gets real distance, or it brings in the local stations on the loud speaker.

All-Amax Senior is a three-tube set with three stages of r. f. amplification, crystal detector and two stages of audio. It is highly selective and brings in the far-distant stations on the loud speaker.

All-Amax Junior (semi-finished) . . . . . $22.00
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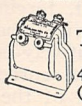

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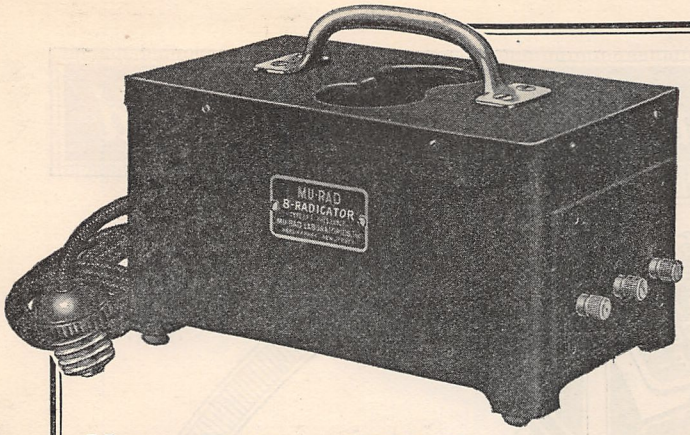


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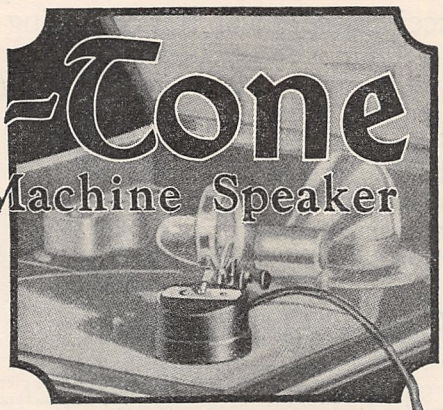

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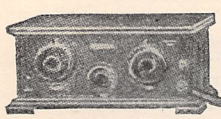

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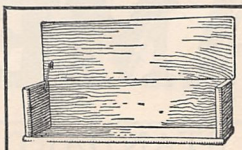

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## Nature of High Frequency Resistance and Effect In Multi-Layer Coils

(*Continued from page* 1425)

directly at 1,000,000 cycles, by remembering that the D.C. resistance of round wire is inversely proportional to the square of the diameter of the wire. In other words, it can be shown that the D.C. resistance is given by

$$R_0 = \frac{0.000062}{D^2} \text{ ohms per foot.}$$

Multiplying these two relations together, we obtain the simple, approximate relation for the resistance of straight wire at 1,000,000 cycles, as given by

$$R = \frac{0.00234}{D} \text{ ohms per foot.}$$

This relation holds only for 1,000,000 cycles, but similar relations can be obtained for other frequencies.

The problem is much more difficult with coils. There is one formula available for computing the resistance ratio of single-layer coils (Bulletin Bur. of Stds. Vol. 4, L. Cohen) which holds over a considerable range of frequencies, and from which the curves shown in Fig. 4 were computed.

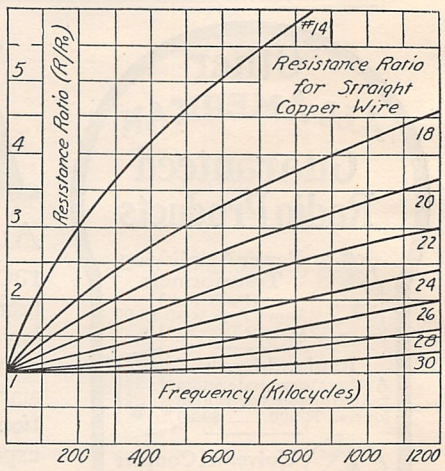
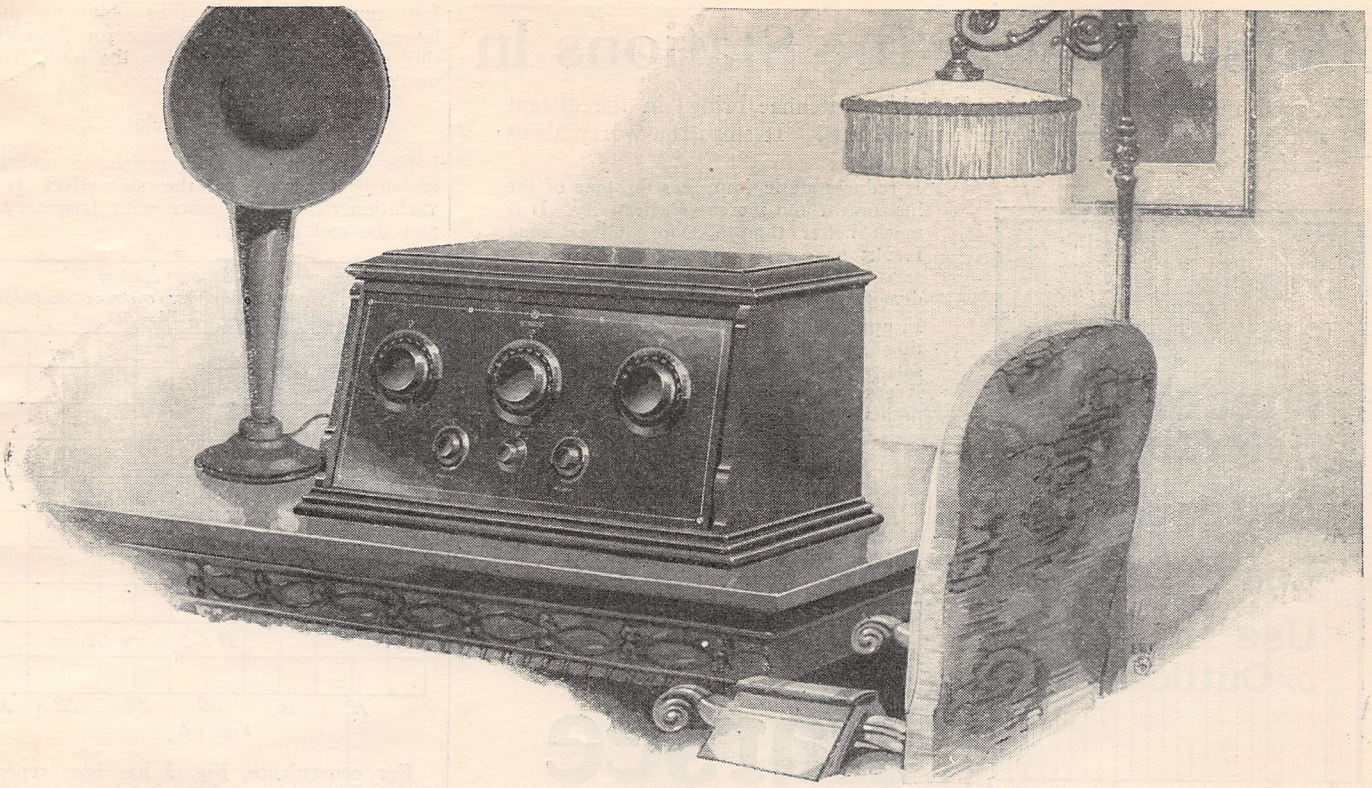



Fig. 4

Comparing these curves with those in Fig. 2, it will be noticed that the resistance ratios are very much higher. This is due to the fact that besides having lines of magnetic flux within the wire itself, forcing the current to the skin of the wire, there is present inside the coil a relatively strong magnetic field which forces the current to use only that part of the skin of the wire which is on the outside of the coil. As a result the skin-effect in coils may be many times that in the ordinary straight wire. These curves are complex and no simple relations can be derived from them as in the case of the straight wires. Hence, the effect for every size wire and every condition of frequency must be computed separately. It was from these curves that the analysis of the high frequency resistance of single-layer coils was made by the writer in the previous article.

In that article an analysis of the high frequency resistance of single-layer coils was undertaken with the idea of arriving at the best size of wire to use in constructing coils of low resistance, and also of determining how the ratio of inductance to capacity in a tuning circuit varies with the coil resistance.

In this article we will consider some of the points that were omitted in the previous article. The first of these points is that whereas many experimenters have been constructing coils whose diameter is equal to



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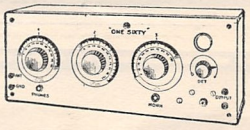

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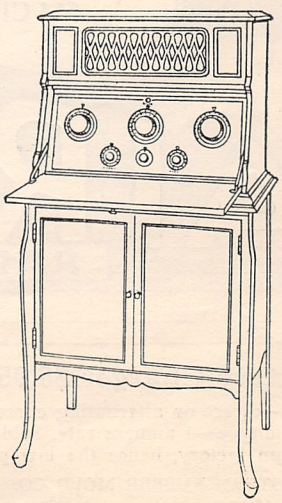

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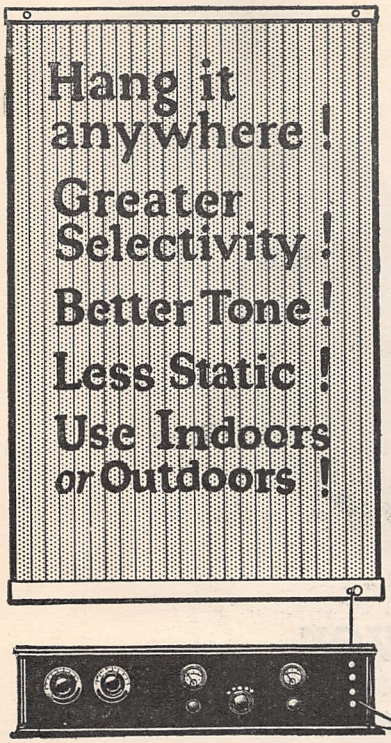


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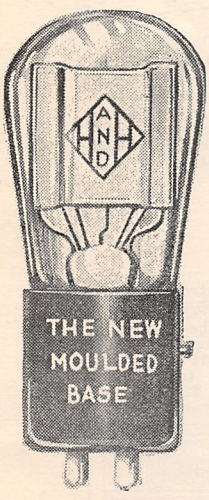


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2.46 times the length, thus obtaining the lowest direct current resistance for the coil, this ratio does not hold for the high frequency resistance. The ratio

$$\frac{\text{diameter}}{\text{length}} = 2.46$$

holds only for the D.C. resistance and is seriously affected by the skin-effect (or variation of the resistance with frequency) and the coil capacity.

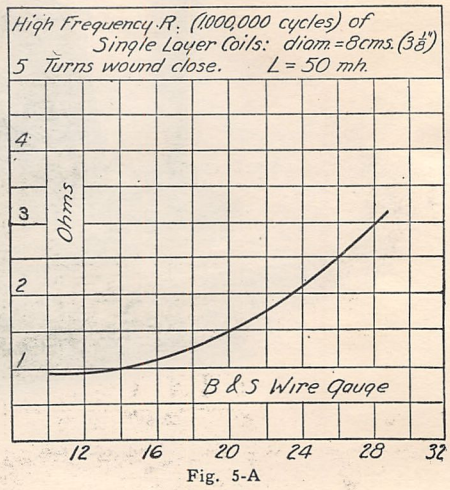


Fig. 5-A

For convenience, Fig. 5 has been reproduced from the previous article, and on it have been marked the values of the above ratio for three coils of the same diameter, but of different inductance. The lowest points of the curves are chosen, viz., at No. 14 wire. These ratios vary from about ½ in the case of the 200-microhenry coil to 1 in the case of the 100 mh. coil, and is likely to be a little larger for the 50 mh. coil.

It is apparent, therefore, that attempting to arrive at the lowest resistance for a coil may result in rather high resistance, if the ratio 2.46 is adhered to. The reader must remember that these figures were arrived at by calculation and are subject to error on account of other losses in the coil which can not be calculated, as for instance, insulation losses. It has been pointed out before, however, that although these other losses cause errors in the calculation of the exact resistance, they should not materially change

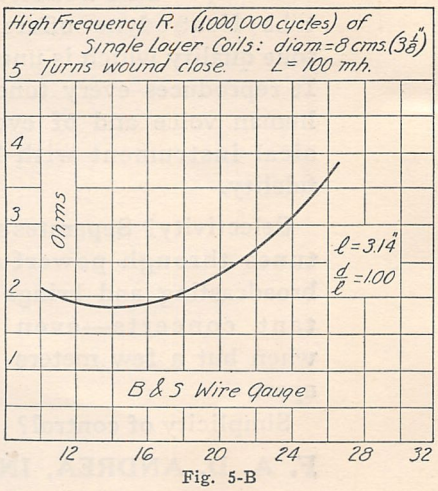


Fig. 5-B

the position of the low points of the curves with respect to the wire size, at least in coils which do not have very great distributed capacity.

For the convenience of the reader we will summarize the conclusions reached in the previous article:

1. The resistance of single-layer coils wound with D.C.C. wire, is lowest when made of No. 14 wire, neglecting coil capacity.

2. Since, in single-layer coils the capacity effect is small compared with the skin-effect,

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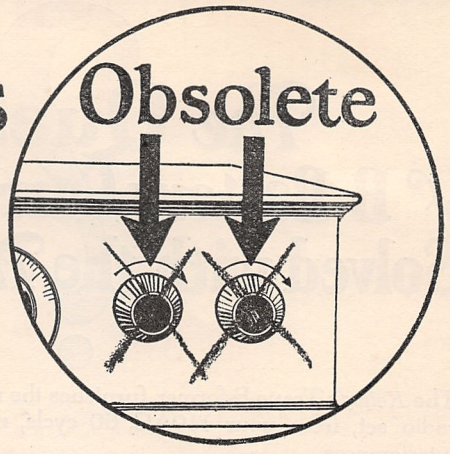

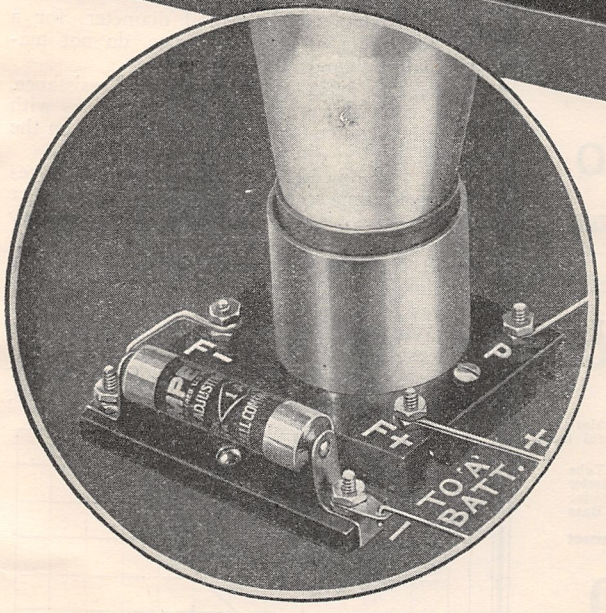


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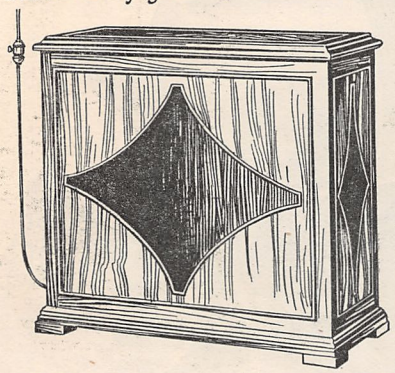

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coil capacity does not play an important part in the resistance of single-layer coils, though this slight capacity may make it advisable to use No. 16 wire instead of No. 14.

3. When the coil capacity becomes serious for any reason, it causes the lowest point of the curve to move to the right, or toward the smaller wire sizes, and at the same time raises the curve bodily upward.

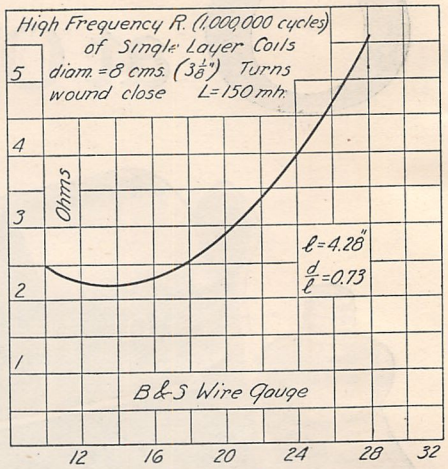


Fig. 5-C

4. Dielectric or insulation losses do not change the position of the lowest point appreciably, but raise the curve bodily upward.

5. Variations in the coil diameter, for a given value of the inductance, do not materially change the resistance.

6. The ratio of inductance to resistance, for coils of a given diameter, increases with the inductance or the number of turns on the coil.

7. The lowest point of the curves moves almost imperceptibly toward the smaller wire sizes as the frequency becomes very high.

8. Spacing the turns moves the lowest point to the left, permitting larger wire sizes to be used.

We will now try to apply some of these ideas to analyzing the resistance of multi-layer coils. Formulae are not known for computing the skin-effect in multi-layer coils,

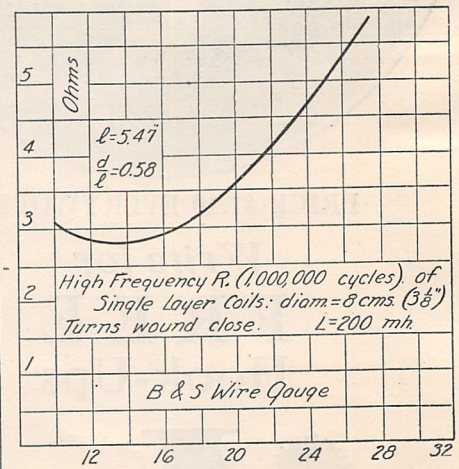


Fig. 5-D

but we can use the formula for the single layer coil as the basis of our argument. Let $R_0$ represent the resistance *per foot* of wire on the coil, and $R/R_0$ the skin-effect. Then, if n represents the number of feet of wire on the coil, and Ra/R represent the effect of coil capacity, the total resistance (apparent) of the coil is

$$n \times R_0 \times \frac{R}{R_0} \times \frac{Ra}{R} = Ra$$

The ratio $R/R_0$, due to the skin-effect is obtained from the curves in Fig. 4, or from

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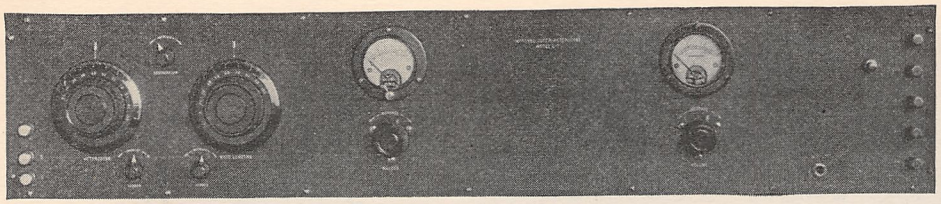

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$$\frac{R}{R_0} = 1 + 9.28\ N^2 d^3 \sqrt{f}$$

from which the curves have been derived. Now, at radio frequencies, the quantity "one" is relatively small as compared with the last term in the formula. Thus where the total resistance ratio becomes as high as, say, 40, then 1 is only 2.5 per cent. of 40. For the sake of argument, therefore, let us suppose that the resistance ratio is proportional to the *square* of the number of *turns per inch* in the coil. (In the formula above, N is the number of turns per inch of length of the coil, f is the frequency in kilocycles and d is the diameter of the wire in inches.)

Let us now consider two coils having the same inductance, but one of these having only a single layer of turns, and the other having two layers, each layer having the same number of turns. Both coils have the same diameter and are made of the same size wire.

$R_0$ is the same in both coils, since they are wound with the same size of wire. This is the D.C. resistance in *ohms per foot of wire.*

$R/R_0$ has been more than *quadrupled,* since we have doubled the number of turns per inch by using two layers of turns, and the ratio is roughly proportional to the square of N.

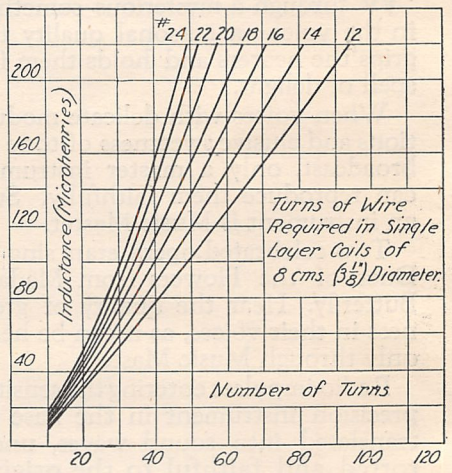



Fig. 6

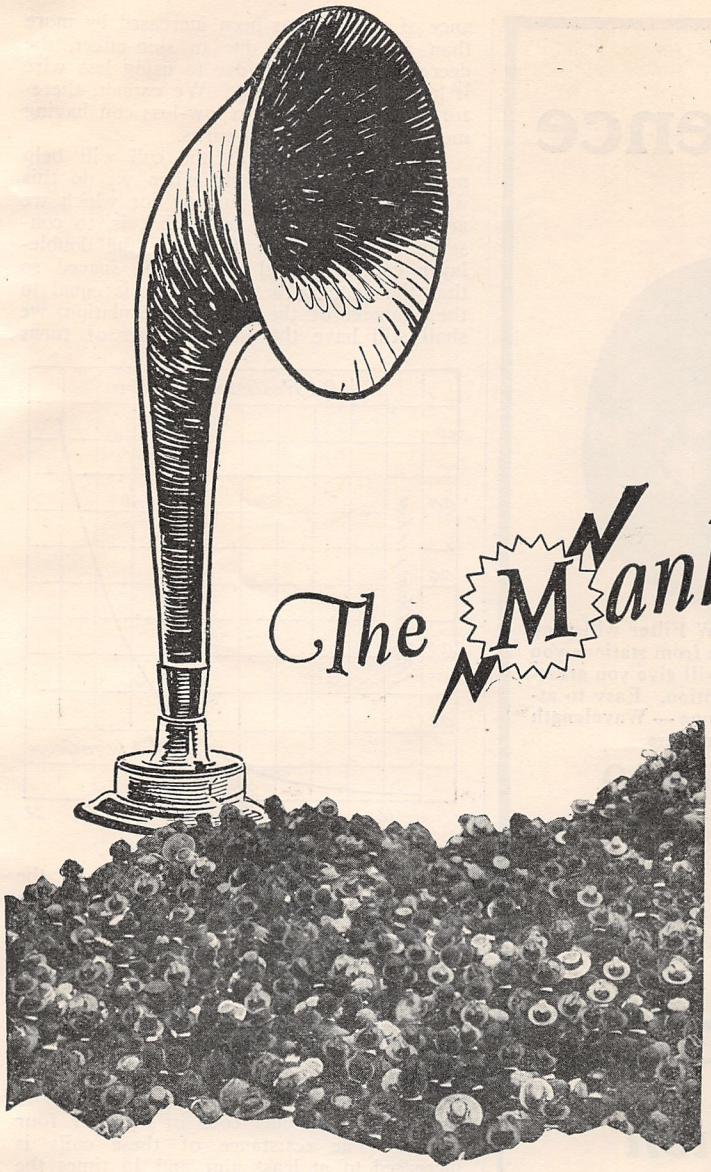
Ra/R has increased a little, due to the capacity between layers and between turns.

Although we are not able to calculate the skin-effect in double-layer coils, it is reasonable to believe that since it varies as the square of the turns per inch in the *single-layer coil,* it *cannot vary less than this* in a multi-layer coil. Suppose, for the sake of argument, it does vary as the square of N. According to this, we see from the above that due to the skin-effect the resistance ratio has *at least* been quadrupled meaning that the total coil resistance has at least been quadrupled if we should have the same length of wire in each coil. Added to this we have the coil capacity raising the resistance still further.

The next point to consider is the number of feet of wire in each coil. Fig. 6 shows the number of turns of wire required to give various values of inductance in coils having a diameter of 8 cms. (3⅛ inches). From these curves the turns required to give 100 microhenries have been picked off and inserted in the following table. (All the coils considered here are closely wound.)

| Wire Size | Turns required in single-layer coil | Turns required in double-layer coil | Per cent. decrease in amount of wire required |
|---|---|---|---|
| 12 | 49 | 39 | 20 |
| 14 | 43 | 34 | 21 |
| 16 | 39 | 32 | 18 |
| 18 | 36 | 30 | 17 |
| 20 | 34 | 29 | 15 |

This table shows that, whereas the resist-



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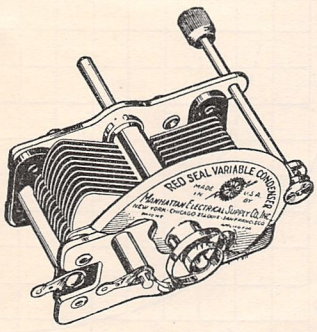


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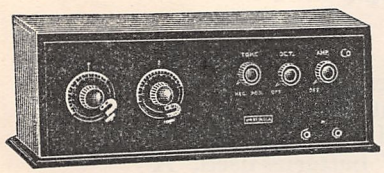

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ance of the coil has been increased by more than 300 per cent., due to skin-effect, the decrease in resistance due to using less wire is less than 20 per cent. We cannot, therefore, hope to think of a low-loss coil having more than one layer of turns.

Spacing the turns of the coil will help matters considerably, but when we do this we are defeating the purpose for which we are using multi-layer coils, that is, to conserve space. If the turns of the double-layer coil, discussed above, are spaced so that the distance between turns is equal to the diameter of the wire and insulation, we shall still have the same number of turns

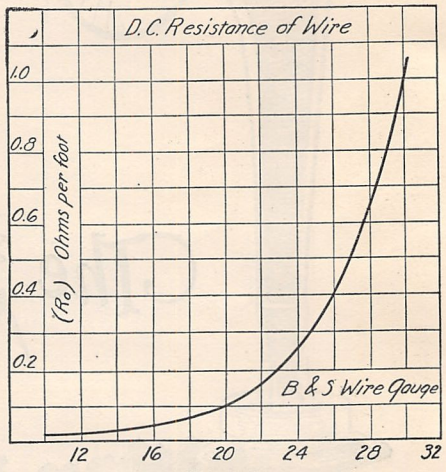


Fig. 7-A

*per inch of coil length* as we had in the single-layer coil. The increase of resistance due to skin-effect, therefore, will be small if any, but more wire will be needed in the coil to give us the same inductance due to the spacing.

The resulting coil will, therefore, be little shorter than the single-layer coil of the same diameter and wire size closely wound, and its resistance will be somewhat higher. The enormity of the skin-effect can be seen more easily if we consider coils of three or four layers. The resistance of these coils is increased to at least nine and 16 times the resistance of the single layer coil wound with the same wire and the same spacing between turns.

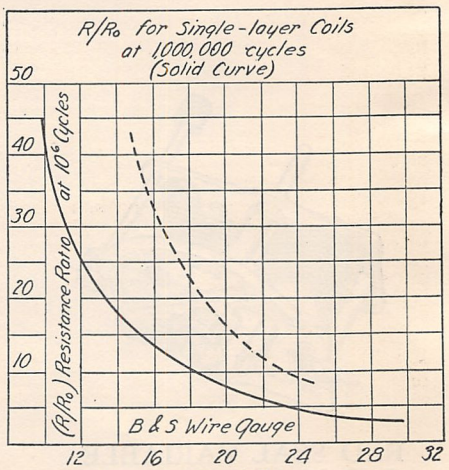


Fig. 7-B

This great increase in the skin-effect moves the lowest point of the resistance curve of the coil toward the smaller wire sizes. Fig. 7, taken from the previous article, shows the variation of $R_0$ and the resistance ratio $R/R_0$ for single-layer coils of the same diameter (8 cms.). Now if, for any reason, as for instance, by doubling or tripling the number of layers, the skin-effect is increased to four, nine or 16 times its value for the single-layer coil, the curve $R/R_0$ will become very steep, as indicated by the dotted curve. When these values are

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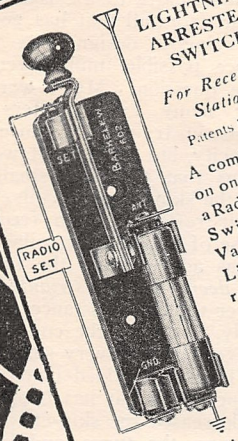


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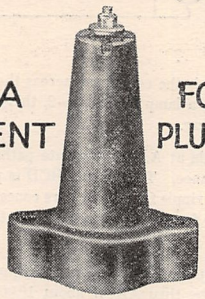

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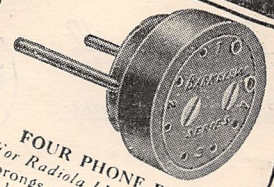

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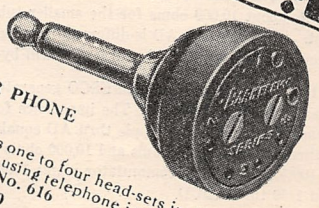

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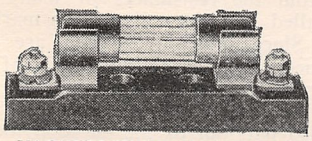

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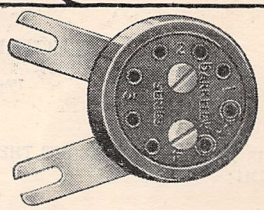

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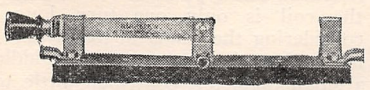

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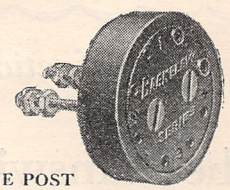

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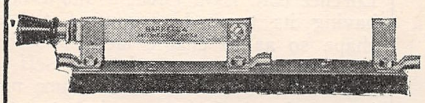

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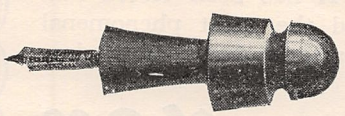

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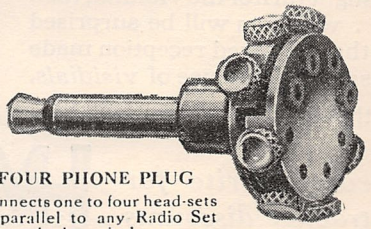

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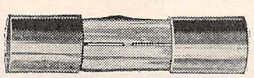

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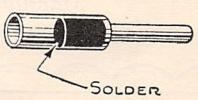


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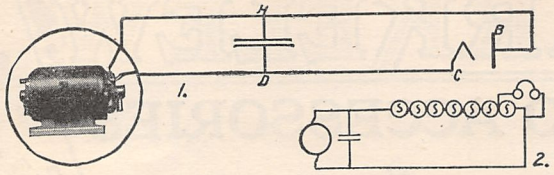


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A 1 mfd. condenser across an ESCO generator with a commutator ripple of 2802 and a slot ripple of 934 will produce the following results. The impedance for D.C. thru AD is infinite, thru ABCD about 10,000 ohms. The impedance for commutator ripple thru AD equals 56.8 ohms, thru ABCD 10,000 ohms. The impedance for slot ripple thru AD equals 170 ohms and 10,000 ohms thru ABCD. Following the paths of least impedance the D.C. passes 100% thru ABCD, commutator ripple 176/177 thru AD and 1/177 thru ABCD, and the slot ripple 58/59 thru AD and 1/59 thru ABCD.

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multiplied together $(R_o \times \frac{R}{R_o})$ and then multiplied by the number of feet of wire, the resistance curve of the coil (Fig. 5) will become steeper on the left-hand side and will begin to turn upward sooner. This causes the lowest point to move to the right.

It seems, then, from all that has gone before, that in trying to design coils of the lowest resistance possible, multi-layer coils are out of the question. Much work has been done by many experimenters with multi-layer coils in trying to reduce their distributed capacity, but from what we have learned it seems that this is a small item compared with the skin-effect in coils, or the increase in their resistance with frequency. Even in the case of single-layer coils, writer after writer has advised that the turns be spaced *so as to decrease the distributed capacity* and so lower the coil resistance. It does this undoubtedly, but since the coil capacity in the single-layer coil was very small in the beginning, we have not gained much by reducing the capacity. What has happened is that we have decreased the skin-effect *enormously* by spacing the turns, and have so lowered the resistance considerably. The attention of designers, therefore, should be directed more toward reducing the skin-effect by a proper choice of wire size and spacing in coils. This is an old story, but is not generally known to designers, judging from the resistances of many of the so-called low-loss coils on the market.

Since multi-layer coils are out of the question in considering coils of low resistance, we will consider only those types which are in effect single-layer coils. This also puts out of the question the spider-web type of coil, which is in effect a multi-layer coil, having only one turn to the layer. These turns are bent out of the circular shape so that the coil may be wound around a group of pins arranged radially about a central supporting core.

The number of turns per inch of coil length in this type of coil is very great, since the coil is only one turn long, without considering the bends in the wire. Furthermore, since the turns near the middle, having a small diameter, contribute little to the inductance of the coil, the amount of wire used on this coil must be large compared with the ordinary single-layer coil. It is, therefore, an unfavorable arrangement, as far as concerns resistance, and it is probable that we would have to sacrifice too much in efficiency in using this coil for the saving in space that is effected.

The basket wound coil, also called the Lorentz coil, is in effect a single-layer coil, having its turns bent out of the circular shape so as to enable lacing of the turns together and so make the coil self-supporting. It should have a resistance nearly as low as the single-layer coil, but not exactly as low, since on account of the irregular shape more wire is required on the coil to obtain a given inductance.

All of the various types of coils can be analyzed in this way, and it should not be a difficult problem for the designer to build a coil of low resistance or the purchaser to make the proper judgment in buying a low-loss coil.

## Dr. Rogers Wins Patent Suit

(*Continued from page* 1391)

the stern of the submarine, where it was electrically connected, utilizing the metallic hull of the submarine as part of a loop. A great many of the U. S. Naval submarines are equipped with Dr. Rogers' patent, which is one of the best means of undersea radio communication, when the submarine is submerged.

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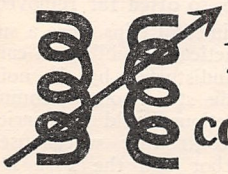

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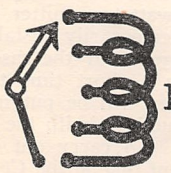

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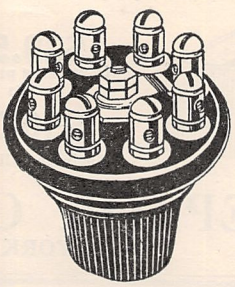
Jos. W. Jones parts make set-building easier, too, for they require *less drilling* and *no soldering.*



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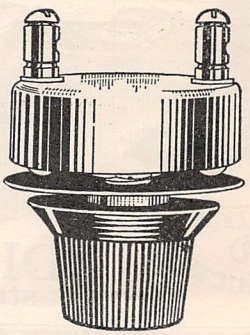
*Low Loss*



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Jos. W. Jones Jacks and Switches are anti-capacity. Made for radio use only. No long parallel leads; which means no capacity effects. Always ask for the switches with the little red button.

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*The Perfect 4 Tube Circuit—Loop Operating*

This wonderful circuit uses four tubes and has two stages of radio frequency, a crystal detector and three stages of audio frequency. Developed by the Research Engineers of the Radio Receptor Company, working under the direction of Lieut. Greiff, of Super Heterodyne fame. The tone quality is really captivating. No station too far away to be brought in consistently. It can be assembled by any one in a few hours. For simplicity and ease of tuning, as well as power and quality of reception, it is far superior to a 5-Tube Neutrodyne.

FREE Complete literature that's educating as well as interesting. Just ask your dealer or write direct for assortment No. 2. Kits also sent postpaid on receipt of purchase price if your dealer can't supply you.

**$29.50**
Containing principal parts

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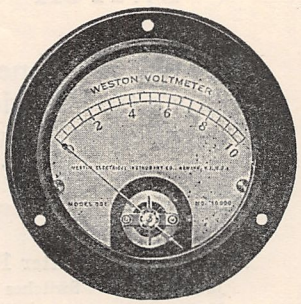
# Bring in the distant stations

You can do this only when your conditions are the best. A Weston Filament Voltmeter will tell you instantly if your tubes are receiving proper voltage. Also by operating tubes at correct filament voltage, the life of tubes is increased at least twofold. This Model 301 Weston Voltmeter costs little more than a tube. With a Weston Voltmeter you can always duplicate instantly previous results. For quick tuning and good reception, it is an absolute necessity. Case diameter 3¼ in. Every instrument guaranteed. Get one for your set today. The Weston Electrical Instrument Company has pioneered the development and manufacture of electrical indicating instruments for 36 years in every branch of the electrical industry.




Booklet J is a splendid 24-page booklet discussing the proper operation of a radio set. Instrument connections for the various hookups are shown. Get this book. It will be sent free on request.

WESTON ELECTRICAL INSTRUMENT CO., 173 WESTON AVE., NEWARK, N. J.

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Earn big profits, prizes, and awards selling RADIO NEWS. SCIENCE & INVENTION, THE EXPERIMENTER, and MOTOR CAMPER & TOURIST in your neighborhood. We train you as our salesman and pay you liberally for your time. Write at once and we will help you to get started. *M. BRIDWELL*

THE EXPERIMENTER PUBLISHING COMPANY
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It was the Court's opinion that Dr. Rogers conceived the idea more than a year before the plaintiffs claimed to have invented it. Also he had successfully demonstrated it to Naval representatives at Key West in 1918. Due to the fact that Dr. Rogers could receive no information from Naval authorities concerning the progress of his work, he continued work on his device at his private laboratory at Hyattsville, Md., using a "simulated submarine." Dr. Harris achieved fame chiefly on account of his underground antenna first demonstrated by him during the war. This consisted of 4-inch pipes buried in the ground and extending 100 to 200 feet each side of his laboratory and connected electrically as in a submarine.

Dr. Rogers has received more than 50 patents, many of them being of an electrical nature. He was chief electrician at the Capitol in Washington from 1877 to 1883. Georgetown University and Maryland State College of Agriculture bestowed on him the degree of Doctor of Science in 1919 and the Maryland Academy of Science awarded him its inventor's medal and the degree of honorary fellow.

## Radio in the Vienna Fire Department

(*Continued from page* 1390)

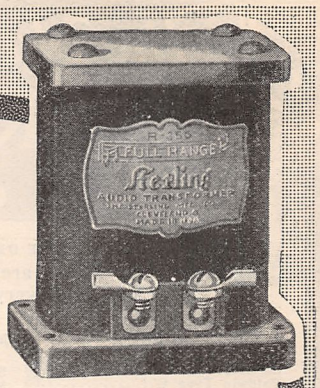
as well as movable stations which could be installed upon a special automobile. The great end which the Fire Department hopes to attain by the installation of radio apparatus on fire engines is that the engines, even during their rush through the streets, shall be in constant touch with the Central Office, and eventually can be directed from one scene of conflagration to another; or, if no more help is needed, can also be called back to their stations at once. In a short time apparatus will be carried by all the fire automobiles. The advantages and use of this improvement lie principally in the case where a distant fire has to be dealt with, to whose suppression the City Fire Department's help may be called, and where those at work on the fire can communicate by radio with the central office without using the telephone, so often far removed.

The experimental trips were a success and show the practical possibility of carrying out the idea. Undisturbed by the noise of the motors and the street sounds, communication in both directions could be carried on between the controlling warehouses at the Danube Harbor and the Fire Department Central Station.

### THE RADIO EQUIPMENT

And now to go into technical details: It is to be noted that in the Vienna Central Station two aerials, each 165 feet long, are stretched in parallel. Here it may be remarked that the Central Station is established in a beautiful building, 300 years old. The two antennae are independent of each other, but can be connected together if desired. The 200-watt transmitter now in use has only been temporarily installed on account of the urgency of the case and code is employed. In a short time transmitters of 500-watt power will be put into service, which will communicate with the vehicles by radio telephone. To carry out the desired end it is important that in the Central Office the receiver, and on the auto fire engines the transmitter, shall be very sensitive and well designed. The answers from the engines are given in Morse code and make it desirable, in order to secure better control, that the receiver in the Central Office be connected with a loud speaker. The radio transmitter, which in a short time will be installed upon the vehicles have a so-called

# Three Ways To Obtain More Pleasure and Better Results From Your Set

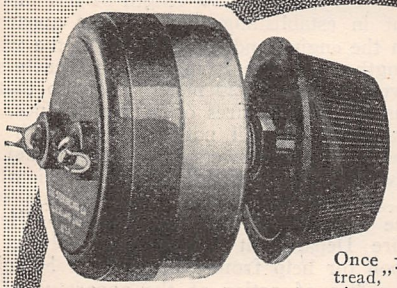



## 1
## Get the "Full Range" of Audio Amplification

The equal amplification of all audible vibrations has at last been made possible. The beautiful low tones of the cello or organ, the clear high tones of the violin or female voice, in fact the whole gamut of sounds, musical or otherwise, are faithfully reproduced by the Sterling "Full Range" Audio Transformer. You will never know how much of the splendid entertainments you have been losing until you have tried this wonderful new design of transformer. You will for the first time hear the full, round, pleasing tones of the broadcasters as though you were in their studio. Rich in appearance, compact, improved wiring facilities.

**Sterling "Full Range" Audio Frequency Transformer**

***Price $6.00***



## 2
## Your Rheostat Should Be of the "Soft-Tread" Type

Once you have used a "soft tread," you will agree that its virtues have not been exaggerated. You cannot feel the broad scientifically formed contact move from wire to wire and there is absolutely no wobbling. You obtain unbelievably free, smooth, noiseless movement in either direction. The customary grating sensation will not come later, either. The non-tarnishing resistance wire and phosphor bronze contact are completely enclosed to keep out dust. It is a beautiful thing, too, with moulded bakelite base and nickeled case. Mounted through a single hole, easily and securely.

Price $2.00 (5 and 15 ohm), $2.25 (30 and 50 ohm)
Potentiometer $2.75 (400 ohm)

**Sterling "Soft Tread" Rheostat**

## 3
## Neutralized As Easily As Setting the Hands of a Watch

Neutralizing neutrodyne and similar sets with the Sterling Microcondenser is just as easy as setting the hands of a watch. Simply turn the little rotary plate to the neutralized position and let go. The work is done!

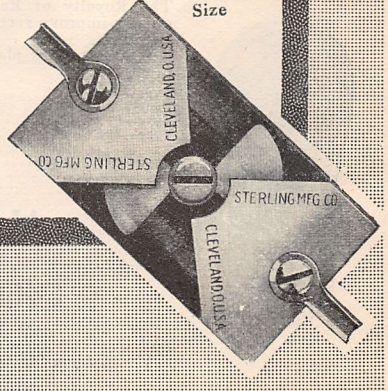
Nothing on the market compares with it in simplicity and effectiveness. Nothing has aroused so much enthusiasm.

**Maximum capacity approx. 5 micromicrofarads**

Actual Size

Price $1.00 each

**Sterling Micro Condenser**




# Sterling Radio Equipment

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**Other Sterling Radio Devices include rectifiers, pocket meters, panel meters, and radio frequency amplifying transformers.**

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We will then send you the Sterling Radio Booklet free of charge.

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| Certified Lo-Loss, 13 plate | 2 00 |
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Type—00 .....5 Volts, 1 Ampere Detector Tube
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ALL TYPES **$2.50**

Type—02 .....5 Watt, Transmitters, $3.00

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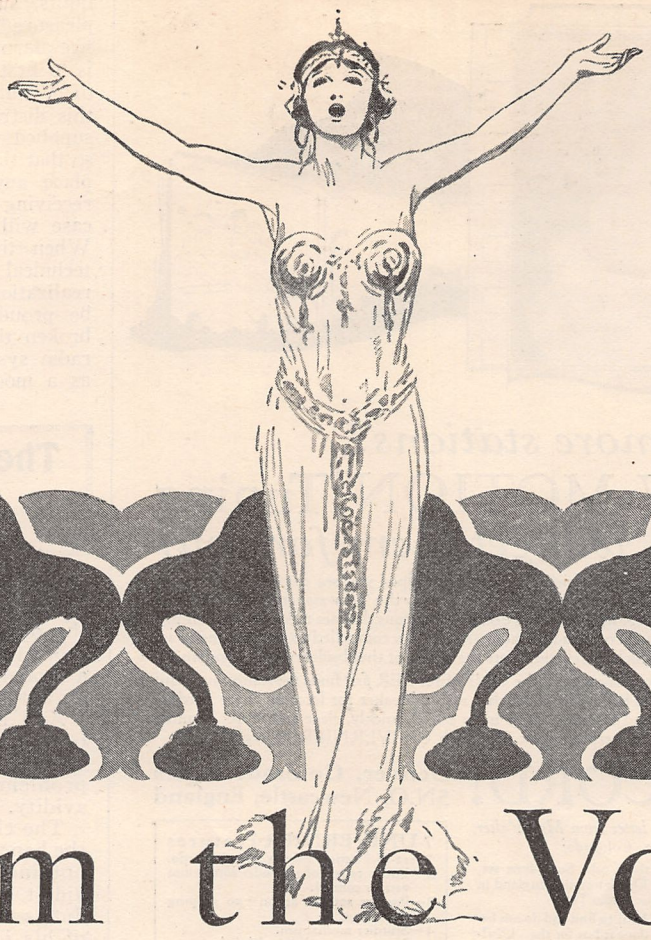
balanced hook-up, application for the patenting of which has been made by the Schrack firm. The transmitting goes on without back-coupling. Using the balanced hook-up just mentioned, with the help of two vacuum tubes, or any desired number of tubes, which are coupled, the increase of current in one tube indicates a reduced current in the other. This arrangement establishes a negative resistance like that introduced by the Dynatron of Hull in the United States, and makes possible the production of oscillations without the use of coils entirely by condenser action and resistance. Shrack employs new transmitting vacuum tubes, which require a very slight heating current and give a 50-watt delivery with a heating current of only .4 ampere at 12 volts.

The receivers include three vacuum tubes, a regenerative detector and two stages of audio frequency amplification. Honeycomb coils are used for tuning, together with condensers arranged for locking in position. As can be seen in the photo, the antenna on the vehicle is a simple aerial of about 26 feet long, and is carried on the hook and ladder truck and fire engines in the same way as ladders and hose lines are arranged, so that the antenna wire is not in the way of the working firemen. The set is grounded to the frame of the auto.

The present transmitter in the Central Station works on a wave-length of 680 meters, but in establishing the complete apparatus on the engine and minor stations, the wave-length will range from 300 to 400 meters in five divisions of 20 meters each, so that in case of several fires occurring at once, the transmissions will not interefere with one another. The answers from the fire chief are always received in the central station, which is in direct telephonic communication with the various sub-stations. As the Vienna Fire Department has already been called upon for help from a distance of 50 miles, a radius of action of the apparatus of 90 miles is contemplated. It must be noted that the fire engines, on account of the shortness of their antennae, cannot use the full wave-length of 600 meters, but one of only 260 meters; but this is quite sufficient for the present needs. Although the Austrian Central Government has hitherto withheld the exclusive right of concession to the transmitting station, and has not yet concluded its arrangement with the city of Vienna with regard thereto, the use has been permitted with regard to the public welfare and safety.

Fire Director Wagner, not satisfied with the radio communication between apparatus and central station, is restless in attaining greater ends, and he has thought out a highly original plan of establishing radio fire alarms. The line of thought which led to this, is that new fire alarms shall be arranged with short antenna to receive their power from the nearest 220-volt lighting circuit of the public electric system. The transmission shall be arranged on the same principle as that used today in the automatic apparatus for transmission by wire. It will be done by pressing a key or drawing out a handle, which will release clockworks to bring a conduction section into action, which will transmit the Morse symbol of the fire, whether roof, general conflagration, etc., and signal the nearest fire station. The conducting segments will automatically return to their original position. From the installation, as mentioned above, a great saving is expected, especially in the material now used, for the conducting lines. Technically, everything is not yet worked out. The present circuits have a length of about 620 miles of pole wires and 300 miles of cable, necessitating a considerable personnel for inspection and maintenance.

Especially valuable will be the arrange-



# I am the Voice

I am a violin. I am tom toms. I am grand opera and vaudeville.

I enchant youth like the Pied Piper. I am a teacher. I am town crier.

Verily, I shrink the world . . . But never am I my own master . . .

For Thorola Loud Speaker can sing and play and speak only what goes into the radiocasting microphone—nothing is lost—nothing is added but volume.

Extreme volume is suggested by the very size of the Thorola reproducer—so large as to permit scientific accuracy which is impossible in miniature!

But the greater the volume, the purer the tone must be to satisfy the musical ear. So it was absolutely necessary for Thorola to introduce features associated only with finest musical instruments.

The exclusive Thorola Controlled Mica Diaphragm was created, bringing highest musical art to radio. And for the first time the overtones —which *make* true music or natural voice—are preserved in all delicacy by the Thorola Separix found in no other loud speaker.

For the beauteous Thorola horn, Thorite was evolved, a laboratory compound, acoustically perfect beyond natural materials. For harmonizing *each* Thorola with the characteristics of *each* radio receiver, the Thorola Synchronizer is provided, putting Thorola always at its best on every set, ready to bring the radio of a continent in the very finest music-room style. Let Thorola betterments bring the culture of music to your radio set.

Under the remarkable 10-day Refund Warranty, Thorola *must* fulfill every claim — *must* improve power, range, TONE QUALITY.

THOROLA 4, $25 THOROLA 9 (*Cabinet*) $40
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Thorola models require no battery
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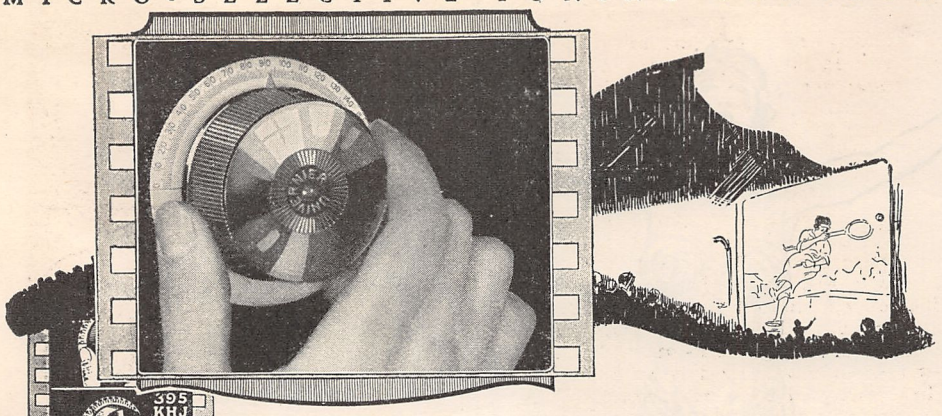
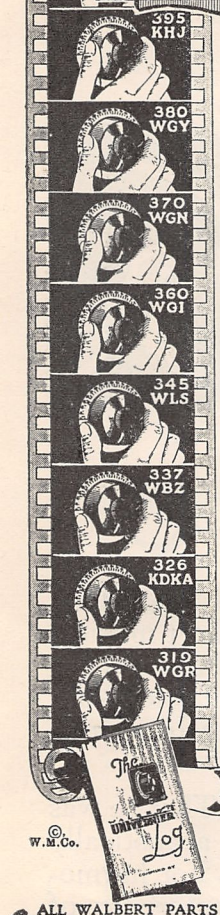
## THE SPEAKING LIKENESS

MICRO-SELECTIVE TUNING CONTROL






*Want more stations?*

"SLOW-MOTION" Tuning *will get them for you!*

REMEMBER how the *"slow-motion"* picture helped you see details that were unnoticed in the usual running? In a similar way the *"slow-motion"* (12-to-1 ratio) of the UNIVERNIER helps you find dozens of stations that are missed if "searching" is done with the usual coarse adjustment (as you are compelled to do with many so-called vernier dials which merely duplicate the action of the obsolete vernier condenser). With its continuous *"slow-motion"*, the UNIVERNIER *first* finds the station you want *—then* clears it up. That's why it's such a record-breaker for locating those hard-to-get distant stations and bringing them in so easily, quickly, clear and loud. Promise yourself a real surprise—replace your dials with UNIVERNIERS tonight!

A RECORD! Denver, Colorado hears 5N.O. Newcastle, England

*Read this interesting letter from Mr. Walter E. Kessler, of Denver, Colorado:*

Gentlemen: Using a three tube Superdyne set, I tuned in station 5N.O. Newcastle, England in the recent Trans-Atlantic Radio Tests.

Believe me they were hard to find and do not believe that I could have done it but for the "UNIVERNIERS" with which the set was equipped.

I thought that you might be interested to know that your UNIVERNIERS were used on a set that reached out this distance.

**7 UNIVERNIER Features**
1—12-to-1 ratio—proven the *right* ratio.
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Mahogany Knob and Gold-plated dial . . $1.50

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A radio socket wrench that fits every round and hexagon radio nut

Sockets ranging from ¼" to ½"

How it works

Place socket of required size on end of shaft with slots not in line with lugs on shaft.

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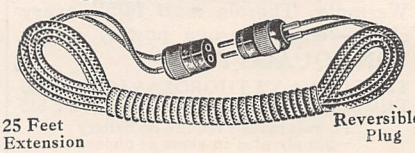

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Reversible Plug

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*Sold at all reliable Radio Stores.*

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Get a Handy Binder for your RADIO NEWS. Holds and preserves six issues, each of which can be inserted or removed at will. Price 65c. Experimenter Pub. Co., Inc., Book Dept., 53 Park Place, N. Y.

ments for places lying outside the city limits, such as great recreation parks and pleasure centers, where at present a wired fire alarm system costs too much. The plan is to first supply the 21st district of the city of Vienna with the alarm station, because this district, as the newest one, is not yet supplied with the old automatic fire alarm, so that the proposed installation will not displace any others now in existence. The receiving of radio communications in any case will always go to the central station. When this plan after the overcoming of technical difficulties will be brought into realization, the Vienna Fire Department can be proud that they are the first to have broken the way for the installation of the radio system, and as having worked it out as a model for all.

## The Blessing of Craftsmanship

(*Continued from page* 1419)

at which a great number of the most important of the list entered. It gave them the opportunity to do something a little more important than the construction of a model of the old mill or the placing of an automatic opener on the garden gate.

And being entirely selective, only the best and most intelligent of the race came into the game. They tore into the problems and the deep technicalities with avidity. It was just what they wanted.

The clerk in the store or the worker at the bench or the teacher of biogenetics has nothing he may call his own. That is, he didn't have until Radio came along. The duties of his position or the exigencies of his job were routine affairs. That is, it was simply the application of something he had learned in his youth. Thus it lacked romance. No man can let his imagination roam, while he is repeating the same process for the hundredth time.

But then came Radio. Everything about it was new. Even the primary laws were none too well known. There was not the slightest difficulty about romanticising it. And it had the added advantage of tickling the acquisitive instinct. Whatever accomplishments were made belonged to their maker. We may chide the Pharisee all we please, but just the same, there are few of us who do not like to survey ourselves in severest criticism and then intone in a deeply grateful voice, "I thank God that I am not as other men." And that is primarily why the great craftsman, like the great musician, takes a joy in his work. And that is why Radio offers the most logical and best field for the conscientious craftsmen, since it offers the greatest field for achievement.

And here is where the Ham ranks. The man in the business for the weekly check automatically reduces himself to the grade of the clerk and the teacher of biogenetics,—from the Ham's point of view. The Ham is an artist, a scientist laboring for the love of his work. The professional reduces his art to the mere business of getting his daily ham sandwich and cup of coffee.

This is the turn where the craftsmanship comes in. Since he is working solely for the glory of his own work, there is every reason for his doing it in the best possible fashion. In other words, he knows that God sees in the corners, and judges himself accordingly.

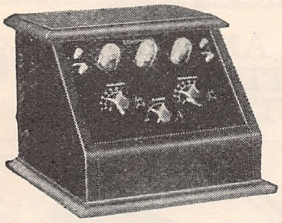
And the more glory should be given for the fact that most of the corners are mental ones, making the necessary application and work just a little more difficult of completion, and, therefore, a lit-

# And Now The ECHOPHONE "4"

## *for Cutting through Powerful Locals in Congested Broadcasting Districts*

A combined radio and audio frequency four tube receiver of unusual selectivity. Two tuning dials with special adjustment for volume. May be carefully calibrated for logging new stations. Non-radiating—clear toned, easy tuning. Without Tubes and Batteries—

**$75.00**



The Echophone "V-3" an exceptionally powerful 3-tube set. Uses dry batteries. Two dial tuning. Range 1800 to 2000 miles. Without Tubes and Batteries—

**$50.00**

No more waiting for "silent" nights to get outside stations! With the new Echophone "4" you can cut through the locals any evening and bring in with loud-speaker volume the far-off programs you want to hear.

One setting of the two tuning controls selects only the station desired —rejecting all others regardless of their power or the nearness of their wave lengths. Once the dial-setting for a given station is determined, that station always comes in if it is on the air when the dials are again placed in the same positions.

The circuit which makes possible such marvelous selectivity, as perfected by Echophone engineers, consists of one stage of tuned (compensated) radio frequency amplification, detector and two stages of audio amplification. The tuning circuits have been carefully balanced. Radiation is entirely eliminated preventing any possible interference with other nearby stations. Uses four "UV-199" tubes thus permitting operation on dry batteries.

All parts are assembled in a handsome Adam Brown mahogany finished cabinet which has ample space for all batteries.

Never before has a four-tube receiving set offered so much in *volume, tone quality* and *selectivity!* Ask your dealer for a demonstration. Meantime send for descriptive folder. Use the coupon below. Address

**THE ARMAC RADIO COMPANY, Agents**
**1120 North Ashland Avenue - - - CHICAGO, ILL.**
*Manufactured by* The Radio Shop, 1120 North Ashland Ave., Chicago, Ill.
LONG BEACH, CAL. SUNNYVALE, CAL.

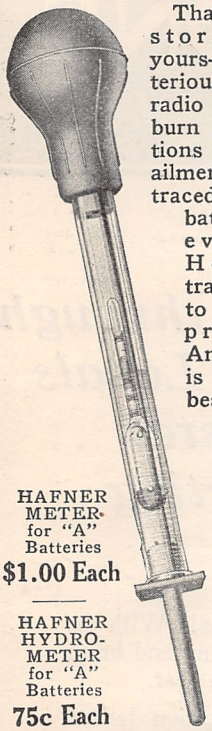
# ECHOPHONE

## *Storage Battery Results at Dry Cell Cost*

THE ARMAC RADIO CO.,
1120 North Ashland Ave., Chicago, Ill.
Please send folder describing fully the Echophone "V-3" and the Echophone "V-4". My Radio dealer is
.....
My Name .....
My Address .....

**Dealers: Get in Touch With Your Jobbers.**

# The Mysterious Value



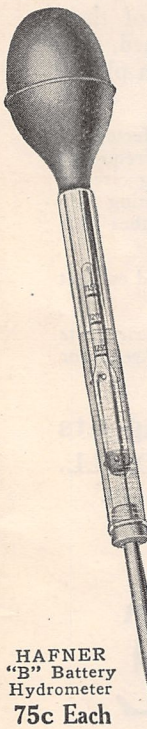
That black box—that storage battery of yours—it's the big mysterious value in your radio set. Tubes may burn out and connections may break—these ailments are readily traced. But when your battery "goes bad," even Sherlock Holmes couldn't trace your troubles to it without the proper instrument. And that instrument is a hydrometer—best of all, a Hafner Hydrometer.

HAFNER METER for "A" Batteries
**$1.00 Each**

HAFNER HYDRO-METER for "A" Batteries
**75c Each**

## EFFICIENT BATTERIES MEAN EASY TUNING

Keep your battery efficient and you'll get good clear loud undistorted reception. Any radio engineer will tell you that. And if every few days you will take just a minute's time to dip the nozzle of the Hafner into each of the cells, press the bulb and check the reading, you'll save youreslf hours of aggravating tuning trying to get results with a dead power plant.



HAFNER "B" Battery Hydrometer
**75c Each**

## BUY A HAFNER HYDROMETER TODAY

The Hafner Hydrometer is easy to use. Complete instructions with each instrument. Made in two sizes—Hafner Meter $1.00 and Hafner Hydrometer 75c for testing your "A" storage battery. Also Hafner "B" storage battery Hydrometer 75c. Get one today at your local dealers. If he can't supply you, remit to us, sending us his name and we will see that your order is promptly handled. Do it now for better radio results.

**Hafner Manufacturing Co.**
**3940 Carroll Avenue**
**Chicago, Ill.**

HAFNER HYDROMETER
*"First Aid To Your Battery"*


Insure your copy reaching you each month. Subscribe to RADIO NEWS — $2.50 a year. Experimenter Publishing Co., 53 Park Pl., N.Y.C.

tle more deserving of honor. An examination of the world's history will not disclose a more thorough group of scientists and as large a one at any period or place than the great gang of Hams at present tearing up all available ether with their inquisitive and practical fingers.

Lest this pean seem too saccharine—as the poet might say—let's drop the horn of easy oratory and just add that in all due respect to Ham Radio it must be admitted that this new method of communication and noise has brought into the world a group of men who will make a finer history than did the artisans of old. They are of a higher order, since their knowledge and work are more erudite. They are more to be acknowledged, since their work is all for the work's sake and because their field is larger and more filled with difficulties.

We hereby nominate the great American Ham for a place in the Hall of Fame along with Francis Willard, Dr. Elliott and P. T. Barnum.

*Jay Hollander.*

## Z2AC ESTABLISHES ANOTHER RECORD

*Editor,* RADIO NEWS:

It might interest you to know that on September 4, Mr. Jack Orbell, Z3AA, left New Zealand on the Steamer *Porto Curtis* for London, via Cape Horn. He had an experimental transmitter and receiver erected on the ship using the call X3AA, power input 60 watts at 125 meters. The writer was in constant communication with X3AA until he left Montevideo. He received my phone at Cape Horn and I last worked him while he was anchored in Montevideo harbor. I also have worked another Argentine station, DB2, operated by D. Cataneo, 11 Lavalle Street, Bahia Blanca, who transmits on 100 meters.

On Wednesday, September 24, another record was established by my station (2AC) when, in the space of two hours and 40 minutes, Z3AA off Falklands Island R-DB2 and R-CB8 were all worked one after another. I am now in constant communication with Argentina and transmit on 100 meters with 2.4 amperes in the aerial. R-CB8 is on 115 meters and his signals are audible about 50 feet from the loud speaker. using three tubes (detector and two stages of audio frequency). Mr. Orbell relayed his messages through CB8 and reported my sigs QSA in Rio de Janeiro.

IVAN H. O'MEARA, Z2AC,
Customs and Pitt Street,
Gisborne, N. Z.

## A LETTER FROM A-2ZZ

*Editor,* RADIO NEWS:

It might be of interest to you for me to submit the list of U. S. Hams I have heard, I thank you for publishing the list, which I sent in just after the trans-Pacific tests. Since then I have added to it and am doing so every Sunday night.

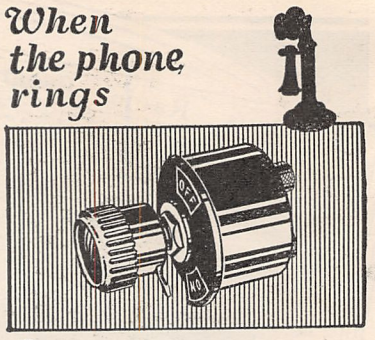
6CGW here is audible all over my room on the loud speaker using detector and one audio in low loss circuit, Meissner, with a .0006 mfd. Kellogg condenser. The size of the room is 12 x 8 feet.

Will you please announce that my wave is 140 meters and that I call nearly every night, and for sure Saturday and Sunday from 6:30 to 7 p. m. and then irregularly until 9:30 p. m.—Melbourne time.

I have called 6CGW often, but NO Results! I presume he believes there is no one working above 120 meters, because the NZ stations are down there. Australian stations are allowed a minimum wave of 125 meters!

My best DX is 2,400 miles C.W. and 1,500 miles phone on one UV-202, input 16


*When the phone rings*



*Snap* ~
AND ALL IS SILENT
*Snap again* ~
AND THE PROGRAM CONTINUES ~
*without retuning*

No modern set lacks the convenience of a MAR-CO filament battery throw switch. Its definite on and off positions make it far superior to any pull switch. Saves tubes and batteries—you don't forget to turn them off! Saves annoying interruptions when you only want to stop reception for a minute!

*Make your set convenient with a*
**MAR-CO**
RADIO PRODUCTS
ON AND OFF BATTERY SWITCH **$1.00**

**Dependability is another word for Reputation.**

Have you noticed how many prominent writers and engineers specify

**Daven Grid Leaks**
**Sold Everywhere**

Read the "RESISTOR MANUAL." A thirty-two page handbook on Resistance Coupled Amplification with interesting data and hook-ups.

Price 25 cents
*At your Dealers*
**DAVEN RADIO CORP.**
*"Resistor Specialists"*
**Newark, New Jersey**

# THE NEW MODEL C-7 SUPER-HETERODYNE

## Important Today

THE EXPERIMENTERS INFORMATION SERVICE, Inc., has been recommending the Super-Heterodyne method of reception since the early part of 1922. In February, 1923, a Super-Heterodyne of our design was installed on the *S.S. Western World,* pier 1, Hoboken, N. J., in the cabin of Dr. Horatio Belt. On the voyage to Rio de Janeiro, Brazil, at a distance of 3,000 miles, southeast of New York, the entire Greb-Gardner fight was received from WJZ, with sufficient audibility for the entire cabin full of passengers to hear the bout, blow by blow, plainly. At 3,300 miles southeast of New York, an entire evening church service was received from Pittsburgh. At that time there was not another single firm advertising or advocating the Super-Heterodyne. Since then Mr. A. Ancieux, Engineer, Trarivia Elec de Arequipa, Arequipa, Peru, has reported consistent reception from KDKA, WDAP, WEAF, WGY and others, a distance of over 5,000 miles, using a Model "C" Super-Heterodyne. The Pratt & Brake Corp., of New York City, sent a Model C to Rio de Janeiro which received American broadcast station at a distance of over 7,000 miles.

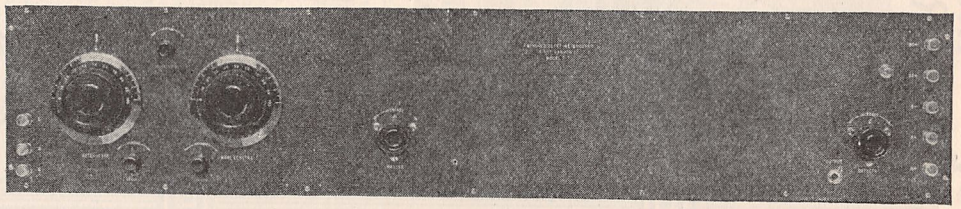
Practically all concerns now featuring Super-Heterodyne have copied our original Model C design, and to prove again that we are far in advance of competition, we present this Improved Model C-7 Super-Heterodyne as the *Most Sensitive, Most Selective,* and finest reproducing Broadcast Receiver that can be built.

## 7 Tubes Give the Results of 10

***The Reason:***—When regeneration is added to a one tube non-regenerative receiver, the increased amplification is about equal to adding two stages of tuned radio frequency amplification. Heretofore it has been impossible to add regeneration in the 1st Detector of a Super-Heterodyne and accordingly this has been a big loss.

The new Model C-7 Super-Heterodyne has a special 1st Detector circuit with a split antenna inductance so arranged that normally the detector would oscillate continually. However, in addition, a neutralizing condenser is inserted in the circuit which gives absolute control of the oscillations to such an extent that the circuit can be adjusted to just below the oscillating point, as this adjustment gives the maximum regenerative amplification. The new circuit has a bias potential on the 1st Detector grid, in place of the usual grid leak and condenser, and this allows infinitely weak signals to be regenerated and heterodyned through the radio frequency amplifier, which an ordinary grid leak and condenser would block. On a weak signal the difference in sensitivity is very noticeable. Using a 22-foot indoor antenna in the suburbs of New York loud speaker reception has been obtained from KGO, Oakland, California. A normal range of 2000 miles is easily obtained on an average small antenna at night under average conditions.

## "The Rolls-Royce of Reception"



MODEL C-7 SUPER-HETERODYNE

**Wave-length Range, 200 to 575 meters. Dimensions, 40 in. x 8 in. x 8 in.**
**Tube Arrangement: Regenerative Detector, Oscillator, 2 Stages Radio, Detector, 2 Stages Audio.**

## General Information

ANTENNA: Single wire, 30 to 150 feet long. Provision has been made for use of either a short or long antenna. Indoor antenna works very satisfactory.

TUBES: 7 Radiotrons UV201A or C201A, requiring one 6 volt storage battery and one 90 volt B Battery either dry or storage.

DRY CELL TUBES: Radiotrons UV199 or C199 may be used if desired, but the results obtained with dry cell tubes are not as satisfactory as with the Radiotrons UV201A or C201A.

LOOP: As a loop takes considerable space and is objectionable looking, and furthermore an inefficient collector, no provision has been made for loop reception. Local reception can be had without antenna or ground. An indoor antenna 30 to 50 feet long is suggested in place of a loop.

SELECTIVITY: The degree of selectivity is so high that distance stations can easily be tuned in through the local stations. For example, with a C-7 located five miles from WJZ operating on 455 meters, WCAE Pittsburgh on 462 meters can be tuned in without interference with WJZ.

TUNING: There are only two tuning adjustments, one for the detector circuit and one for the oscillator. Each station has a definite point on each dial and will always be found at these calibrations. Individual Verniers are provided for each dial. A third Vernier controls the volume.

CONSIDERATIONS: The Second Harmonic feature could be used with a view to eliminating another tube, but we feel that the many advantages of having a separate oscillator more than compensates for the extra tube. For a similar reason we have refrained from Reflexing the circuit to reduce the number of tubes.

STANDARDIZATION: All the component parts specified are readily obtainable on the market through high-class dealers.

PARTS: The parts specified in this design are all selected with expert consideration with a view to giving the maximum results obtainable. While it may appear that certain other parts could be used to economize, we strongly recommend that you take advantage of our engineering experience and follow the specifications to the letter.

**Original Blue Print showing all data, diagrams, circuits, details, etc., $1.00, postpaid**

# EXPERIMENTERS INFORMATION SERVICE, INC.

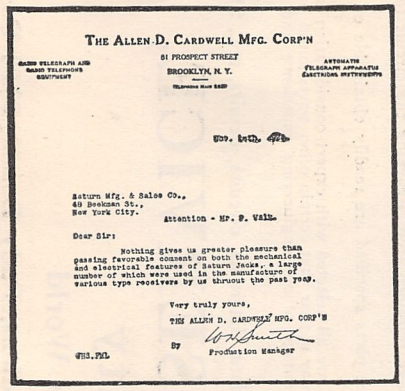
## 476 Broadway, New York City

**Designers of the Highest Class Radio Apparatus in the World**

**New Book, "Modern Radio Reception," by Charles R. Leutz, over 250 Pages, over 150 Illustrations, Fully Bound, $3.00 Postpaid**

CARDWELL'S CHOICE

TRADE SATURN MARK


THE ALLEN D. CARDWELL MFG. CORP'N
81 PROSPECT STREET
BROOKLYN, N. Y.

Saturn Mfg. & Sales Co.,
49 Beekman St.,
New York City.
Attention - Mr. P. Walk.

Dear Sir:

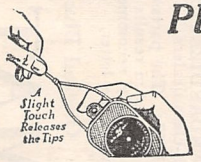
Nothing gives us greater pleasure than passing favorable comment on both the mechanical and electrical features of Saturn Jacks, a large number of which were used in the manufacture of various type receivers by us thruout the past year.

Very truly yours,
THE ALLEN D. CARDWELL MFG. CORP'N
By
Production Manager

*For Better Connections*

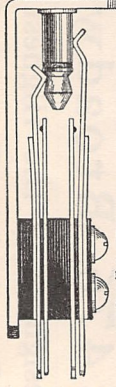
SATURN

*Improved Automatic Plug*




No screw driver, no soldering iron—just insert the phone cord tips and "instant grip" makes positive connection. Released, without disturbing plug, by just a light touch on the lug. Neat Bakelite cases with no exposed metal—a big value for 75c.

SATURN *"Perfect" Jack*



A "crowfoot offset" at the terminals is already tinned with non-corrosive solder flux compound so that a little heat is all that's needed to connect. Nickel-plated brass brackets with rounded corners; German silver blades; and sterling silver contact points.

SATURN *Battery Switch*

Smoothly efficient due to exclusive balanced blade construction. Easy pull makes, light touch breaks connection. Neat and sturdy. Fits all panels, whatever the thickness. 75c.

Write for a copy of "The Saturn Book of Circuits"

**The SATURN Mfg. & Sales Co., Inc.**
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watts. How does this compare with your stations?

I have never used more than detector and one audio, but think 6CGW would be audible at 50 feet with two audios on my low loss. I hear him regularly.

My main reasons for writing are to get your stations to listen higher than 120 meters and to get QSL'S from those we heard. I will answer all QSL by card.

KGO is being received over here regularly, and works a speaker well in some cases. The country hams have the best luck. Here's my list, every dist. hrd!

1VHT, 1NCO (?) 1VC, 1OR, 1GX, 1ACK, 1AR, 2RD, 2FT, 3AAN, 4AOV, 4MI, 4CAY, 4ACT, 5AW, 5ABG, 5AKN, 5TAD, 6KA, 6CKR, 6RI, 6KKR, 6CKP, 6AV, 6AOV, 6AOS, 6GV, 6AVV, 6COP, 6AAV, 6KT, 6VY, 6CDE, 6CGW, 6TLR, 6JTB, 6BNT, 6AVR, 6BN, 6BV, 6AAU, 6AVT, 6AAO, 6APC, 6GN, 6CC, 6GU, 6NOH (?) 6BCP, 6ASE, 6CTO, 7GD, 7GA, 8BAK, 8GZ, 8CM, 8CF, 9ZT, 9MC, 9YA, 9BG, 9BTE.

That is the lot so far, but now that summer is coming there seems to be many more; only for static one could log 20 a night during the Christmas season. I don't know why there are none to be got in the winter.

Most of those stations were received on a single tube—at any rate, a fair number.

I have been a constant reader of your magazine, as well as *Science & Invention* for several years, and wish you every success.

PRESTON SMITH, A-2ZZ,
83 Labramatta Road,
Tremorne, Sydney, Australia.

## A LETTER FROM A SPANISH AMATEUR

*Editor,* RADIO NEWS:

Will you publish a note in RADIO NEWS to the effect that I will listen for U. S. A. brass pounders during the winter and will QSL any calls heard by radio and by mail?

If the Hams will let me have a card giving me the time they are on the air, also QRH, I will be on the job and will QSL by radio.

FERNANDO CASTANO (EAR-2),
25 Fernandez de los Ries,
Madrid, Spain.

## FRENCH 8FJ BREAKS DX RECORDS

*Editor,* RADIO NEWS:

I am happy to tell you that I have had regular reception from stations in New Zealand and Australia since October 8. The calls heard are: (N.Z.) 1ac, 3ac, 4aa, 4ag, 4sq. (AUST.) 3BN, 3BM, 3BG, 3BD, 3BQ.

I have also received two amateurs of Hawaii: 6ceu and 6zy. I think that it is the world DX record between amateurs. The distance from Pau to Gisborne is about 13,000 miles. Since January 30 until today I have logged more than 770 U. S. and Canadian stations.

I expect very soon to carry on some tests with JFWA at Tokio, Japan, and CB8, now DA8, at Bernal, Argentine.

J. L. MENARS, F-8FJ,
Le Blancat,
Gan B. P., France.

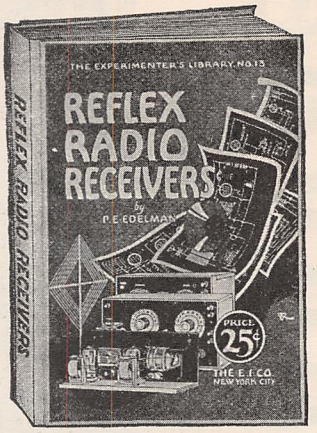
## 1SF MAKES AUSTRALIA

*Editor,* RADIO NEWS:

I was in communication with radio A-3BQ, W. Howdon, Hill Street, Box Hill, Victoria, Australia, from 5:15 to 6:45 E.S.T. on the morning of November 9.

His signals came through strong on 91 meters. One message was given him and two taken from him. One message received reads as follows: "Nr.1. From Wireless Institute of Australia to A.R.R.L., Hartford, Conn. Greetings. Sig. A-3LM."


Reflex Radio Receivers




WHAT REFLEX DO YOU PREFER?

**The new 64-page book giving hookup galore on the finest low cost double duty-reflex circuits**

Only the reflex can give the maximum results on a minimum number of tubes. It's the inherent principle of the reflex circuit that makes the tube do double duty. Therefore the reflex circuits are for the man who wants all the advantages of a high priced radio set at a low cost of construction and operation.

The new E. I. Company book gives complete details on the finest reflex circuits. It gives complete instructions on circuits galore. Contains 64 pages, bound by handsome heavy cover printed in two colors.

Size is 5½ by 7½ inches.

*Sold by all reliable Radio and News Dealers*

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*Prepaid*

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*Sole Distributors*
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233 Fulton St. New York City

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*"RADIO'S FOREMOST PUBLISHERS"*



VOLT-X
VARIABLE GRID LEAK

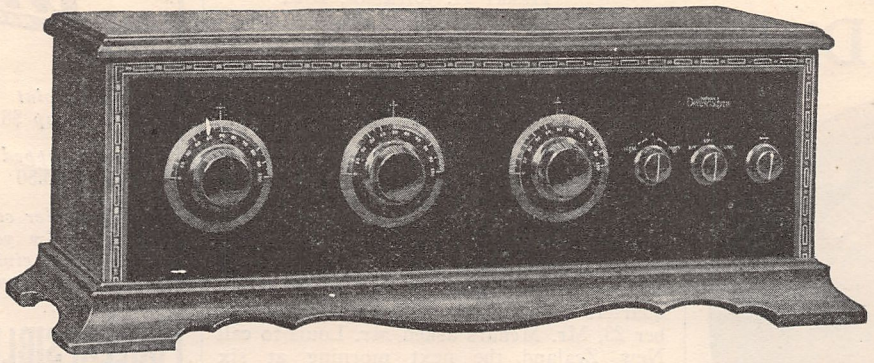
Give Your Tubes a Chance

The Grid Leak determines the efficiency of your set. The proper Grid resistance varies for each tube, and the conditions under which it operates.

VOLT-X GRID LEAKS are positive and smooth in action with an accurate range of from ½ to 15 megohms. They fit any standard leak mounting, and get the absolute maximum from your tubes.

Grid Leak . . . . . $1.00
Grid Leak Mounting .30

BURTON & ROGERS MFG. CO.
755 BOYLSTON ST., BOSTON, MASS.



# The Deresnadyne Circuit

## *stops oscillation at its source*

The Andrews Deresnadyne 5-tube set represents an entirely new principle in the design of radio circuits. The Deresnadyne circuit is the only circuit which stops the oscillation which produces whistling and distortion at its source. It stops oscillation in the plate circuit, before it reaches the grid, which is extremely sensitive and where all adjustments are very critical. It is not like the neutrodyne, which neutralizes the excessive energy which produces oscillation. *It prevents the generation of energy in excess of that which can be effectively used to produce undistorted signals.*

The result is the most beautiful tone quality so far obtained in any radio set. It is entirely free from noises and distortion. Moreover, this fine tone quality, instead of being secured at a sacrifice, is secured with *increased* selectivity and power. The exclusive principle of the balanced plate circuit makes possible the maximum amplification without distortion over the entire range of wave lengths.

With the Deresnadyne you no longer are forced to choose between a set with tone and selectivity and one with volume and distance. These four essentials of fine broadcast receiving are here combined for the first time.

The Deresnadyne is extremely simple in construction and operation. It is easy to log. You can change from 1st to 2nd stage or turn off the set by simply turning the switch knob. The unique *Plate Balance Control* enables you to accentuate either tone quality or power, as you wish.

Operates either on outside antenna, or with even greater selectivity on the special Deresnadyne loop. Hear the Deresnadyne at your dealer's or write to us.

*Andrews Deresnadyne, genuine hand-rubbed mahogany cabinet. Price $150, without accessories.*

*De Luxe Model, genuine American Walnut cabinet, beautifully finished with genuine inlay. Interior and mounting base of polished walnut. Price $165, without accessories.*

DEALERS: *Order through your jobber.*
JOBBERS: *Write to us.*

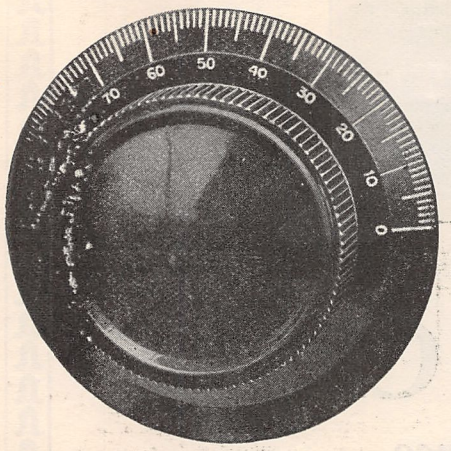
ANDREWS RADIO COMPANY, 327 S. LA SALLE STREET, CHICAGO

# *Andrews* Deresnadyne

DĒ-RĚS'-NÀ-DĪNE · PATENTS PENDING

## *Radio Receiving Set*

# Visco Vernier Dial



A vernier dial operating on a new principle. No gears, hence NO BACK LASH.

Both the quick and the precise adjustment without changing the grip or changing gears (there being no gears). A moderate pressure will turn the dial quickly *to any desired position* and with a light pressure it will creep without jerk or jar precisely to a hair line adjustment. Always ready.

Helps to steady condensers with loose bearings.

**Efficient, Practical and Cheap**

To install, it is only necessary to take off the old dial and put on the new.

Genuine Bakelite, 3¼ inches in diameter, fits ¼ inch shaft. The design is now somewhat changed from the above cut.

If after 10 days trial you are not satisfied, return the dial and we will return the purchase price.

***Price $1.00 Postpaid***

**The Monosmith Brothers Company**
**Spencer, Ohio**



**The Standard of the World**

The base-type
**Freshman Variable Grid Leak**
is the standard for those who build their own sets. It is the most compact and being entirely sealed it always remains unaffected by any climatic conditions.
Complete with either .00025 or .0005 Freshman Condenser— **$1.00**
without condenser..... .75
*At your dealer's, otherwise send purchase price and you will be supplied postpaid*
**Chas. Freshman Company, Inc.**
**106-7th Ave., New York**


I was working on a wave of 79 meters at the time, with one 50-watter. The antenna current was 1.8 amps. with the tube operating cool.

HARRY H. JOHNSON, 1SF,
Short Beach, Conn.

## FRENCH AMATEURS CONNECT WITH NEW ZEALAND AND ARGENTINA

The month of October, 1924, marked an important date for the French amateurs. Several of them have recently been heard in New Zealand and some of them have worked New Zealand amateur stations. Mr. Pierre Louis, F8BF, got in touch with Z4AA and worked him for about three-quarters of an hour. On Thursday, October 23, Mr. Menars asked Mr. Louis to call New Zealand the next morning at six o'clock. His station was heard, and Mr. Menars received the answer on 88 meters. The following Saturday and Sunday, Mr. Menars could still hear Z4AA who could hear F8BF, who was himself unable to receive Z4AA except for a few seconds. Then on Tuesday morning, October 28, at 6 a. m., F8BF sent Z4AA the following message from Mr. Menars. "Message to Z4AA from F8FJ. Do you know an amateur on Maurice Island? Thanks, best 73's. Signed F8FJ." Immediately after Mr. Louis received the answer from New Zealand, very weak but readable and the two stations worked with each other until 7 o'clock, that is, for exactly three-quarters of an hour.

In his messages Z4AA said he could hear the signals from F8BF very loudly on 92 meters. A short while after, Mr. Menars heard a message from Z4AA to G2SL saying that F8BF was received in Australia. Mr. Louis was receiving at the time on a short antenna of 185 meters natural period, with a regenerative receiver composed of detector and two stages of audio frequency amplification. The transmitting antenna system at F8BF is composed of a six wire cage, six feet in diameter with a large counterpoise. This antenna system is used for transmitting as well as receiving.

A short while before this test, F8BF was sending on 43 meters and was heard on the loud speaker in Philadelphia and was also heard on various receivers, without any antenna, in England, Holland, Switzerland and Sweden.

The distance between France and New Zealand is exactly half the circumference of the earth; that is, 12,430 miles, but it is probable that the short waves traveled toward the west, since this portion of the earth was at the time in darkness.

On October 30, Mr. Leon Deloy, F8AB worked from 4 to 6 a. m. with Mr. Carlos Braggio, DA8 in Buenos Aires. The transmission was made on an aperiodic antenna on a wave-length of 86 meters and with but a few hundredths of an ampere of antenna radiation. The receiver was composed of one stage of radio frequency and detector. The distance between Nice, France, and Buenos Aires is 6, 870 miles, of which more than half is over land. On the same date, between 6 and 6:45 a. m., F8AF also worked the New Zealand amateur 4AK on 86 meters. The signals, which were very loud at first, faded away as it became light.

## STANDARD RADIO FREQUENCY TRANSMISSIONS

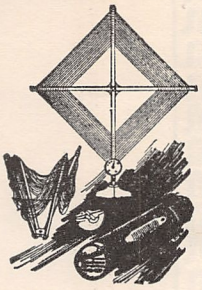
The Bureau of Standards transmits, twice a month, radio signals of definitely announced frequencies, for use by the public in standardizing wavemeters and transmitting and receiving apparatus. The signals are transmitted from the Bureau's station, WWV, at Washington, D. C., and from sta-


Reg. U.S. Pat. Office
**Lincoln** RADIO PRODUCTS

*Four Point Tapped Loop* $8.00

*Center-tapped Loop* $6.50

*If your dealer cannot supply you, order direct giving your dealer's name.*



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**Write for Catalog**

Send your name and your dealer's name for the Lincoln Catalog. Describes Lincoln Loops, Lincoln Low-Loss Condenser, Lincoln "Long 45" Tuner, Lincoln Kit, and Lincoln Oscillascope. Shows 6 interesting hook-ups.

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| Auto Batteries | | Radio Batteries | |
|---|---|---|---|
| 6-Volt, 11 Plate | $12.25 | 6-Volt, 100 Amps. | 12.50 |
| 6-Volt, 13 Plate | 14.25 | 6-Volt, 120 Amps. | 14.50 |
| 12-Volt, 7 Plate | 17.00 | 6-Volt, 140 Amps. | 16.00 |

*Shipment Express C. O. D. subject to examination. 5 per cent discount for cash in full with order.*

**2-Yr. Guarantee Bond in Writing With Each World Storage Battery**

proves satisfactory World performance. Mail this ad with your name and address — we will ship battery day order is received; and give you your choice of "B" Storage Battery or a handsome nickle finish Auto Spotlite, **FREE. Write TODAY.**

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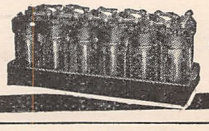
This FREE "B" Storage Battery takes the place of dry cell "B" batteries. Can be recharged and will last indefinitely. To be sold retail for $6.00. It is the only battery of its kind equipped with solid rubber case—and Insurance against acid and leakage. Take advantage of this remarkable introductory offer NOW. (To those who prefer it, we will send FREE a handsome nickel finish Auto Spotlite, instead of the "B" Battery. Be sure to specify which is wanted.)

**GIVEN FREE**
To introduce this new and superior World "B" Storage Battery to the Public.

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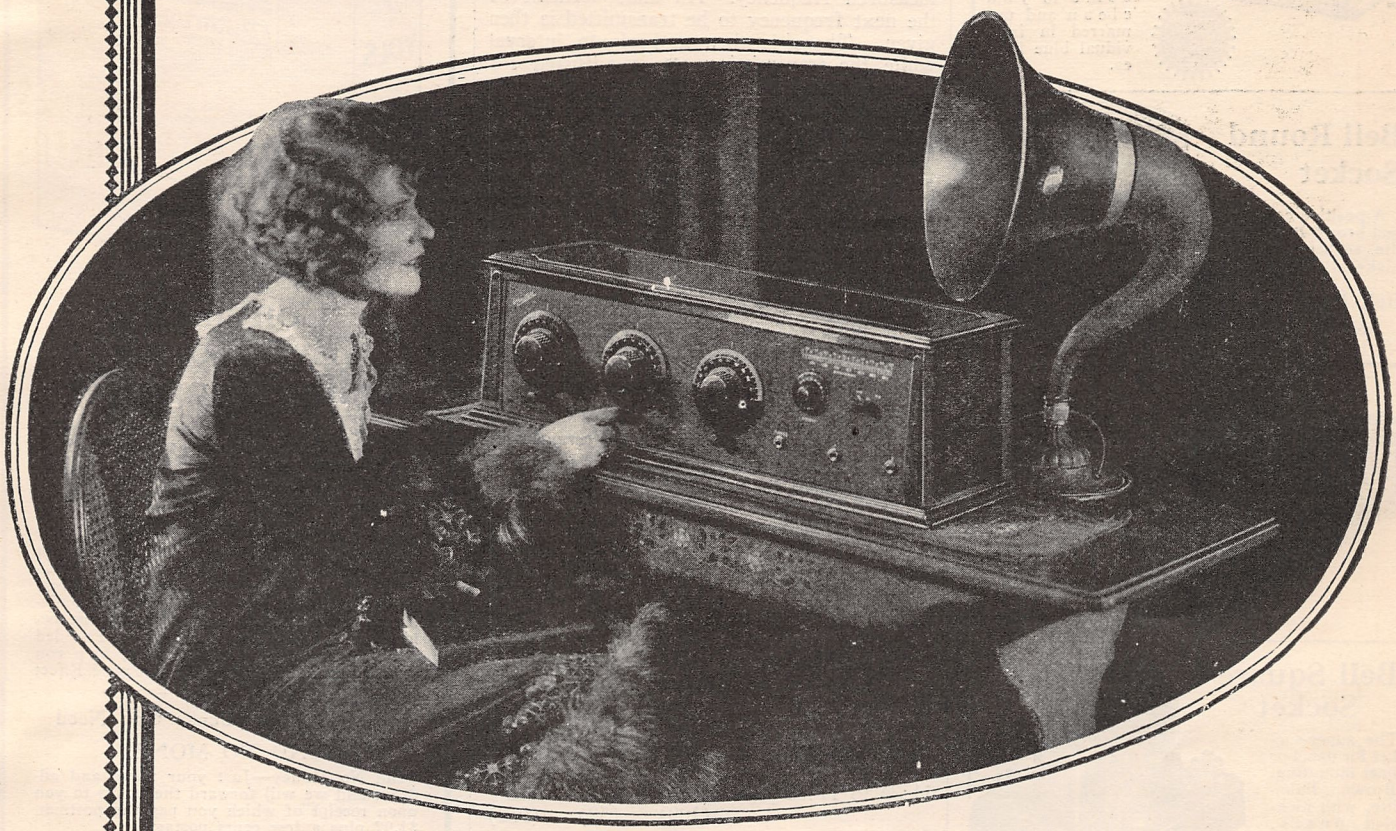
# The Real Secret of Clear Tone and Quiet Operation

***told in simple, every-day terms which everyone can understand***



SOMETHING has recently happened to radio which makes it a much simpler, more dependable and sweeter toned instrument. That something is the *complete* elimination of internal noises by the radio inventor, Carl Pfanstiehl.

The technical means which he employed is a scientific story of great interest to radio engineers. The average radio user does not care about that. But, briefly, in popular language, this is what he did:

For years he had observed what complicated devices were being used to neutralize stray oscillations in the set, the oscillations of radio energy which cause chatter and squeaks and squeals, and often distort speech or music. Potentiometers were employed and extra condensers. These are a makeshift. They only partially succeed; and they need adjustment.

He made up his mind that some way could be found to go to the root of the trouble and eliminate it entirely, instead of merely trying to offset it. By tracing back the oscillations to their separate sources he discovered their true nature and how to keep them out. Nobody had ever known this before.

The remedy is as simple as it is effective. All complicated devices are dispensed with. He so designed the structural relationship between coils and condensers that the stream of radio energy is perfectly controlled; there is no feedback causing stray oscillations. All the radio energy is utilized in developing the true signal. The set is internally noiseless. Speech and music come in without interference. You get a liquid clear enunciation of every syllable and a supremely pure tone.

See and hear this new system that is revolutionizing radio—the Pfanstiehl Model 7—at your dealer's. Or let us send you free descriptive booklet.

Dealers: Write for the special Pfanstiehl proposition.

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**Highland Park 20 Second Street Illinois**

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**Pfanstiehl**

**MODEL 7 RECEIVER**

***A 5-tube Receiver using the new system of tuned radio frequency***

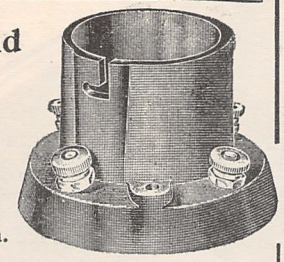
# In the blue box

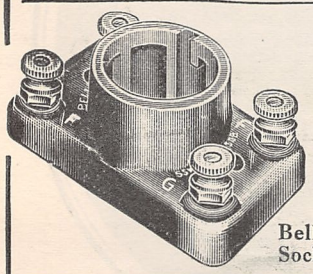
Bell molded Bakelite Dials and Sockets come to you clean and unmarred in individual blue boxes.

## Bell Round Socket

A positive contact brown Bakelite socket with nickeled posts.

Bell Round Socket 45c ea.





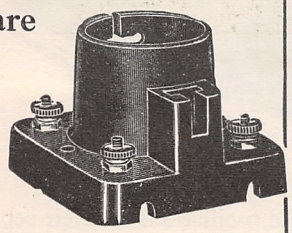
## UV-199 Socket

An ideal double - contact black Bakelite socket. Nickeled posts.

Bell UV-199 Socket...45c ea.

## Bell Square Socket

The super-socket for panel or base mounting. Brown Bakelite, with nickeled posts. Unique double-wipe spring contact.



Bell Square Socket .....80c ea.

*Bell Knobs and Dials* of handsome high-gloss Bakelite add good looks as well as efficiency to your set. In 2" to 4" sizes, 35c to 80c ea. (Also special vernier knobs.)

*Dealers: Ask for radio circular and attractive discounts.*

**Bell Manufacturing Co.**
**11 Elkins St. Boston 27, Mass.**



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*All Standard Types*
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Order from nearest point.
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tion 6XBM, Stanford University, California.

The transmissions are by unmodulated continuous wave telegraphy. A complete frequency transmission includes a "general call," a "standard frequency signal" and "announcements." The "general call" is given at the beginning of the 8-minute period and continues for about two minutes. This includes a statement of the frequency. The "standard frequency signal" is a series of very long dashes with the call letters (WWV or 6XBM) intervening. This signal continues for about four minutes. The "announcements" are on the same frequency as the "standard frequency signal" just transmitted and contain a statement of the measured frequency. An announcement of the next frequency to be transmitted is then given. There is then a 4-minute interval while the transmitting set is adjusted for the next frequency.

The signals can be heard and utilized by stations equipped for continuous wave reception at distances within 500 to 1,000 miles from the transmitting stations. Information on how to receive and utilize the signals is given in Bureau of Standards Letter Circular No. 92, which may be obtained on application from the Bureau of Standards, Washington, D. C.

The schedule of standard frequency signals from both the Bureau of Standards and Stanford University is as follows:

SCHEDULE OF FREQUENCIES IN KILOCYCLES

*(Approximate wave-lengths in meters in parentheses)*

| Time | Jan. 20 | Feb. 5** | Feb. 20 |
|---|---|---|---|
| 10:00 to 10:08 p. m. | 1500 (200) | 3000 (100) | 125 (2400) |
| 10:12 to 10:20 p. m. | 1650 (182) | 3300 (91) | 133 (2254) |
| 10:24 to 10:32 p. m. | 1800 (167) | 3600 (83) | 143 (2097) |
| 10:36 to 10:44 p. m. | 2000 (150) | 4000 (75) | 155 (1934) |
| 10:48 to 10:56 p. m. | 2200 (136) | 4400 (68) | 166.5 (1800) |
| 11:00 to 11:08 p. m. | 2450** (122) | 4900 (61) | 205 (1463) |
| 11:12 to 11:20 p. m. | 2700** (111) | 5400 (55) | 260 (1153) |
| 11:24 to 11:52 p. m. | 3000** (100) | 6000 (50) | 315 (952) |

*Eastern standard time for WWV, Washington, D. C. Pacific standard time for 6XBM, Stanford University, California.

**The schedules marked with this sign are tentative for station 6XBM, Stanford University; later announcement will be made if there is any change.

## NEW QRA'S

**BRITISH 2KK**—(Re-assigned) Ralph H. Parker, Wilson Road, Smethwick Staffs, Birmingham, London. Will welcome reports of transmissions on short waves.

**4TX**—Donald B. Brown; change address to: 48 White Oak Ave., Atlanta, Ga., 10 watts C.W. I.C.W. and fone.

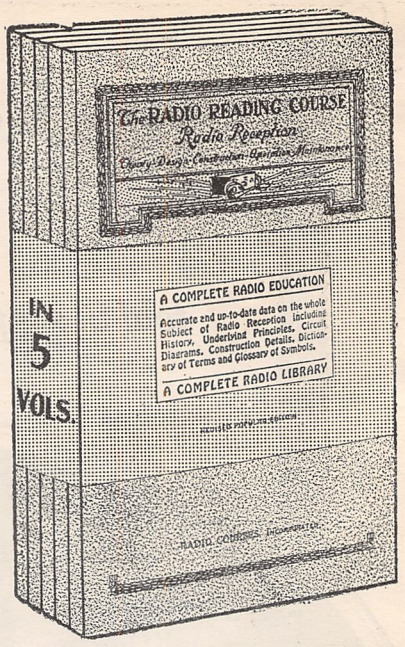
**2HE**—Maurice Suffern, 365 New York Ave., Brooklyn, New York.

**1WL**—(Re-assigned) Arthur C. Egan, 783 Dwight St., Holyoke, Mass. All crds QSL'd.

**9CXG**—Leo E. Yoder, R.F.D. 3, Box 3, Shipshewana, Ind., 5 watts C.W. and fone. All crds answd.

**6BKU**—Bryce Sells, 810 "E" St., Oxnard, California. Reports on my 50-watt C.W. will be greatly appreciated.

**9CDF**—Heber C. King, Avilla, Mo., 20 watts C.W. and fone. Pse QSL QRK?


# "Convincing Even to the Trained Engineer"

*The above quotation of Prof. J. H. Morecroft of Columbia University is taken from his endorsement as printed in The Radio Reading Course, illustrating the authoritativeness of the data in this set of five books.*

**A Complete Radio Education**

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We want a live young man in every town, and in every section of large cities, to own, operate and demonstrate "The Brunswick DeLuxe Neutrodyne." Set furnished you at discount, and special financial arrangements. Write fully about yourself to The Radio Shack, America's Largest Radio Dealers, 55 Vesey St., Dept. B-23, New York City.

## Releases Another Surprise
## THE BRUNSWICK DE LUXE NEUTRODYNE

INDEPENDENT RADIO MANUFACTURERS INC. LICENSED BY NEUTRODYNE UNDER HAZELTINE PATENT NO. 1450080 OTHER PATENTS PENDING REG. U.S. PAT. OFF.

A GENUINE LICENSED NEUTRODNE KIT that can be assembled in two hours from the clear instructions for building and wiring which come with each kit.

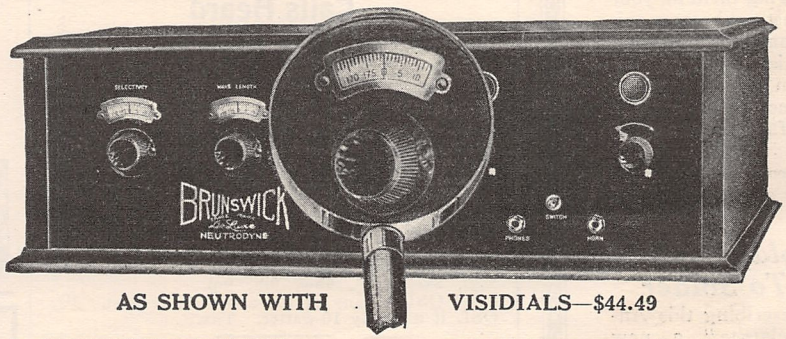
**$39.49** Knock-down without "VISIDIAL"

Here is luxurious beauty, design, synchronization and power. The combination for which the Radio fan has waited so long. A five tube Neutrodyne with a reputation bearing only the highest praise and judgment. A set perfected in every minute detail. A Masterpiece priced for the multitudes.

THE Brunswick De Luxe Neutrodyne, equipped with "VISIDIALS," the dials behind the panel, is something entirely new, something better. It is shipped to you knocked down or semi-assembled and can be wired by any ordinary unskilled layman within a few hours. It is constructed of the highest grade of low loss instruments with careful thought given to their connection and relation to each other. Low Loss instruments are a necessity to perfect reception in as much as they eliminate the loss of energy and enable the signals detected by the antenna to be transformd into audible energy. You will be surprised at what the application of Low Loss instruments and "VISIDIALS" has meant to the Brunswick De Luxe Neutrodyne.

Think it over—a five tube Neutrodyne set for less than $40.00. A set which gathers in broadcast from coast to coast on a loud speaker—clear, loud and powerful.

*Remember*—Send no money, just fill out the coupon. A written money back guarantee goes with each kit.




AS SHOWN WITH VISIDIALS—$44.49

**FREE CABINET**
Beautifully finished cabinet is furnished absolutely free if the Operating and Accessory Outfit are purchased together. If cabinet is purchased separately .....$5.30

## ACCESSORIES

Here is EVERYTHING needed to operate this coast-to-coast set after building:

| | |
|---|---|
| 5—Tested Tubes, Type 201A | $17.25 |
| 2—45 Volt Extra Large Variable B Batteries | 6.50 |
| 1—60 Ampere Hour Storage Battery, guaranteed for 2 years.. | 11.25 |
| 1 pr. 3000 ohm Head Phones and cord | 3.75 |
| 1—Double Phone Plug | .90 |
| 1—Complete antenna equipment | 1.50 |
| | $41.15 |

## STANDARD PARTS

**WITH VISIDIALS MATCHED—SYNCHRONIZED—LICENSED**

1—Drilled Radion Mahoganite Smooth Polished Panel, Reproducing Mahogany Color and Grain, Engraved in Gold.
3—Four Inch Radio Mahoganite Dials, Gold Engraved. 2—Gold Plated Jacks.
3—Genuine Hazeltine Neutroformers mounted on the famous Brunswick Low-Loss Condensers, positively the only kit employing Low-Loss Condensers.
1—6-Ohm Rheostat with Gold Plated Knob to Match Panel.
2—Genuine Killark Completely Shielded Audio Transformers.

| | |
|---|---|
| 2—Hazltine Neutrodons. | 1—.00025 Freshman Grid Leak. |
| 5—Bakelite Sockets. | 1—Set Engraved Binding Posts. |
| 1—Baseboard | 1—.002 Micon Condenser. |
| 20—Feed Tinned Bus-Bar. | 1—.06 Micon Condenser. |

**Instructions in clear, simple Blueprint.**
**Complete Set, $39.49. Packed in Handsome Box.**

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***The Set of the Century***

Synchronized and matched to perfection. Gathers in nation-wide broadcast on three tubes. Remarkably selective tuning possibilities. All standard parts similar to those listed above. Send for literature on this remarkable kit.

PRICE
Knockdown **$27.45**
Operating Outfit **$34.25**

## K. D. RADIO CABINETS

K. D. cabinets are made of the highest grade of Douglas Fir from the Pacific Coast. Kiln dried and selected for their exceptional texture and grain.

They are shipped knocked down for convenience and safety. Easily constructed. All holes drilled and hardware furnished. Can be beautifully stained to match any furniture. Shipped one to each carton, complete.

| PANEL | DEPTH | PRICE EA. | PANEL | DEPTH | PRICE EA. |
|---|---|---|---|---|---|
| 7x12 in. | 7 in. | $2.09 | 7x21 in. | 7 in. | $2.59 |
| 7x14 in. | 7 in. | 2.29 | 7x24 in. | 7 in. | 2.69 |
| 7x18 in. | 7 in. | 2.49 | 7x26 in. | 7 in. | 2.89 |

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CONSOLES—Beautifully made consoles and battery tables made of the highest grade Douglas Fir. Remarkable offer. Price ranging from $7.50 up.

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Gentlemen:—Please send me the semi-assembled radio receiving outfit I have marked. When it arrives I will pay my postman the amount, plus the small carrying charges. I understand that if I am not pleased with it I have the privilege of returning it, as sent to me, and you agree to refund my money. I have marked in square what I want.

CABINET FREE WHEN BUILDING and OPERATING OUTFIT ORDERED AT SAME TIME.
(A) Neutrodyne Building Outfit $39.49 ☐
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(C) Neutrodyne Visidial Outfit $44.49 ☐
(D) Brunswick De Luxe Low Loss Kit $27.45 ☐
(E) Brunswick De Luxe Operating Outfit $34.25 ☐

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Address .....
City ..... State .....

with

**ACME Stranded Enameled Antenna**

Distant signals are always weak. To bring them in, your antenna must not become oxidized. Enameled antenna cannot oxidize.

The seven strands increase your volume by offering a greater surface to the incoming wave.

If not at your dealer's, give us his name and we will send you a

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and also describing this Antenna; "Celatsite," a new Spaghetti covered wire for radio sets; and a very high grade of Spaghetti Tubing.

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**ACME WIRE**
**Makes Better Sets**



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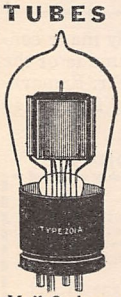

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to tubes that light but are weak or worn down.

**GUARANTEED 500 HRS.**

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**3OO**—Bert Carmosin, 1654 N. Marshall St., Philadelphia, Pa. Gld to get reports.

**6CUW**—D. Cason Mast, Bisbee, Ariz Reports appreciated. All crds answd.

**9DQD**—Duane Magill, 730 N. 6th St., Grand Junction, Colo. QSL's appreciated.

**5NW**—Will use the call 5ASI while at Amarillo this winter. Address all crds to Wayland Groves, 108 E. Eighth St., Amarillo, Texas. All crds appreciated and answd. Will use 10 watts C.W.

**5QS**—(Re-assigned) Claud T. Jones, 5149 Richard Ave., Dallas, Texas. 10 watts C.W. and fone. QSL's answd.

**5ZAV-5AIU**—Le Roy Moffett, Jr. and Dan O. Howard, 824 South Elm, Norman, Okla. Low power 80 meter set. Pse QSL.

### CORRECTION

In the second part of the article entitled "The Heterodyne Wavemeter" by James Wood, Jr., appearing in the December issue of RADIO NEWS, equation 10 should read:

$$K = \frac{M}{\sqrt{L_1 L_2}}$$

## Calls Heard

**5QP—410 REYNOLDS ST., GADSDEN, ALA. (OCTOBER)**

**U. S., C. W.**—2bgi, 2bgm, 2cbg, 2xd, 3aa, 3ad, (3bco), (4db), 4ft, 4gw, 4jr, 4qf, (4si), 4ts, (5abc), (5acm), 5afu, 5akn, 5alz, 5ew, (5ka), (5lh), 5ox, 5qh, 5xa, 8afq, 8alw, (8anb), 8aog, (8arw), 8azh, 8bdk, 8bhw, 8byf, 8byu, 8cta, (8dal), 8dbo, (8jz), 8vt, 9ado, 9ahz, (9aol), 9avb, (9awp), 9axh, (9bcd), 9beg, 8bjp, 9bob, 9brq, (9bvu), 9bx, 9cco, 9ceb, (9cee), 9cyd, 9dby, 9dhg, 9dlm, 9dtt, 9eel, (9ejy), 9eky, 9er, 9jg, 9oa, (9vc).

**U. S.**—spk, 8eb.

**U. S.**—Short wave cw, 1bc, 1px, 2ha, 5aaq, 5agj, 8xe, 9aau, 9bw, 9ih, 9qt.

WI QSL to any of the above on request. Pse QSL if u hr my 10-watter. Tnx.

**9BIO—NEWTON, KANS. (OCTOBER)**

1apu, 1are, 1bc, 1ccg, 1ml, 1pe, 1yb, 2acs, 2byi, 2buy, 2bxc, 2bxw, 2byc, 2cj, 2cjb, 2cnk, 2cqo, 2crp, 2cwj, 2cxy, 2czr, 2kx, 2le, 2xd, 3aa, 3ach, 3ad, 3ah, 3bco, 3bno, 3buv, 3bwt, 3cou, 3cjn, 3ckk, 3hg, 3mf, 3nf, 3pp, 3qt, 3tf, 3uy, 3yy, 3zo, 4ao, 4cr, 4dx, 4dy, 4ft, 4gw, 4jr, 4kk, 4pb, 4si, 4tj, 4tn, 4sb, 4sh, 4vy, 6aao, 6aaq, 6ab, 6abc, 6abe, 6adt, 6afh, 6afq, 6ahp, 6akh, 6akw, 6alv, 6amf, 6ams, 6anq, 6aof, 6aoh, 6aqw, 6ase, 6awx, 6bbq, 6bcn, 6bcp, 6bcq, 6bcs, 6bdt, 6bev, 6bfi, 6bfw, 6bgw, 6bhw, 6bis, 6blw, 6bnf, 6bqa, 6bqc, 6brf, 6bsg, 6bts, 6buy, 6bw, 6bwd, 6bwl, 6bx, 6cba, 6cbb, 6cch, 6cdb, 6cek, 6cfe, 6cgs, 6cgv, 6cgw, 6chl, 6chy, 6cig, 6cjh, 6cnf, 6cnk, 6cnl, 6cqe, 6csr, 6csw, 6ctd, 6ctl, 6cto, 6dd, 6hk, 6ih, 6ii, 6ij, 6im, 6ir, 6ji, 6kt, 6ms, 6of, 6pl, 6pq, 6qi, 6rf, 6rn, 6ti, 6ur, 6wb, 6wt, 6xad, 6zbn, 6zcg, 6zh, 7akk, 7alk, 7cf, 7co, 7df, 7du, 7ge, 7go, 7gv, 7ho, 7hw, 7jh, 7mv, 7no, 7of, 7ok, 7mp, 7ry, 7un, 7uv, 7vx, 8aal, 8abm, 8acu, 8ada, 8adw, 8afs, 8ahj, 8aih, 8air, 8ajf, 8ale, 8alx, 8aly, 8anb, 8apu, 8aq, 8arj, 8ars, 8arw, 8atz, 8aub, 8avx, 8axf, 8axn, 8ayy, 8azh, 8azw, 8bau, 8baz, 8bbf, 8bbw, 8bdv, 8bdw, 8bdy, 8be, 8bf, 8bgn, 8bhg, 8bit, 8bjt, 8bjy, 8bjz, 8bkc, 8bkm, 8blf, 8bll, 8blr, 8bmb, 8bmx, 8bn, 8bo, 8boo, 8boq, 8bp 8bpa, 8bqp, 8brc, 8bsc, 8bsq, 8bsr, 8bsu, 8btf, 8bth, 8bv, 8bwk, 8bym, 8byn, 8bze, 8bzl, 8bzf, 8bzi, 8bzo, 8cap, 8cbm, 8cbx, 8cci, 8cco, 8ccw, 8cdd, 8cdy, 8ced, 8cep, 8chk, 8chy, 8cjp, 8cke, 8ckm, 8cko, 8cmo, 8crv, 8cse, 8ctz, 8cud, 8cuv, 8cva, 8cve, 8cwo, 8cza, 8czt, 8czy, 8dal, 8dcv, 8ddc, 8ded, 8dep, 8dfb, 8dfo, 8dga, 8dgl, 8dgo, 8dgp, 8dgt, 8dig, 8diz, 8djp, 8dki, 8dkl, 8dln, 8dmf, 8dmm, 8dmr, 8dmz, 8dnd, 8dnf, 8dnk, 8dnu, 8dny, 8doo, 8dof, 8dqt, 8dqv, 8dse, 8dzi, 8eb, 8ec, 8es, 8ii, 8ir, 8jq, 8kj, 8lh, 8lo, 8na, 8nt, 8pj, 8pu, 8pz, 8qd, 8rj, 8uq, 8rv, 8rx, 8sf, 8ta, 8tt, 8vq, 8vw, 8vy, 8wo, 8xe, 8yv, 8zo, 8zz.

CANADIAN—1ah, 3ad, 3gg, 3ia, 3ms, 3ph, 3wc, 3wv, 3xi, 4cb, 4cw, 5ba, 5fv, 5hs.

MEXICAN—bx.

PORTO RICAN—4je.

**5DI—706 BROAD ST., SELMA, ALA.**

1ajp, 1bg, 1bgg, 1bgt, 1kc, 1kl, 1ow, 1sw, 1te, 1xam, 1xax, 1zym, 2aae, 2aai, 2aay, 2auv, 2bco, 2bj, 2brb, 2cej, 2cgb, 2cia, 2cjx, 2cua, 2cyw, 2gk, 2ku, 2kv, 2mu, 2pp, 2uy, 2wz, 3aav, 3ahp, 3as, 3bco, 3bdo, 3be, 3bea, 3bfe, 3bsf, 3bsu, 3bta, 3cd, 3jo, 3wsw, 4ai, 4bw, 4bx, 4db,


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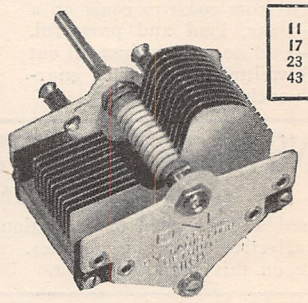

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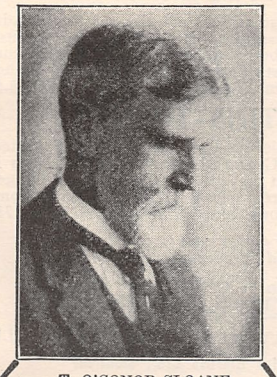

T. O'CONOR SLOANE, A.B., A.M., LL.D., Ph.D.
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I wish to express my appreciation of your prompt reply to my letter and to the recommendation to the General Electric Co. I intend to start the student engineering course at the works. This is somewhat along electrical lines, but the fact that I had a recommendation from a reliable school no doubt had considerable influence in helping me to secure the job.—H. VAN BENTHUYSEN.

So far I've been more than pleased with your course and am still doing nicely. I hope to be your honor graduate this year.—J. M. NORKUS, JR.

I find your course excellent and your instruction, truthfully, the clearest and best assembled I have ever taken, and yours is the fifth one I've studied.—JAMES J. KELLY.

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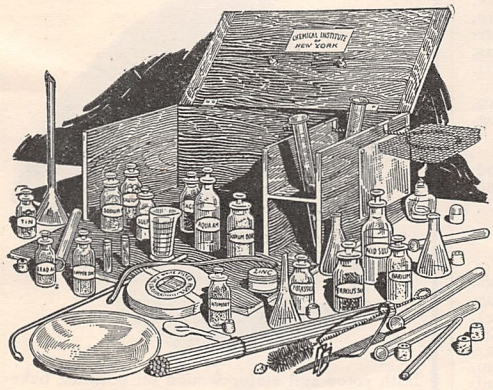
I shall always recommend your school to my friends and let them know how simple your lessons are.—C. J. AMDAHL.

I am more than pleased. You dig right in from the start. I am going to get somewhere with this course. I am so glad that I found you.—A. A. CAMERON.

I use your lessons constantly as I find it more thorough than most text books I can secure.—WM. H. TIBBS.

Thanking you for your lessons, which I find not only clear and concise, but wonderfully interesting. I am—ROBT. H. TRAYLOR.

I received employment in the Consolidated Gas. Co. I appreciate very much the good service of the school when a recommendation was asked for.—JOS. DECKER.

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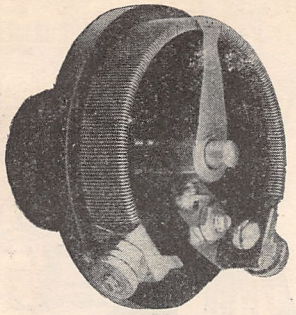

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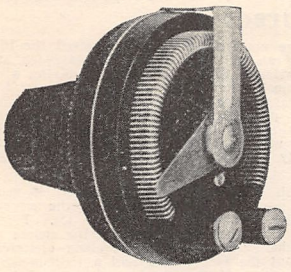

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MEXICAN—1b.

CANADIAN—3aa, 3gg, 4kt, 4pr, 9ap.

PORTO RICAN—4ja, 4sa, nkf, nfu, nfy, wgh, wgy.

---

### 2WZ—654 EAST 23RD ST., BROOKLYN, N. Y. (NOVEMBER)

C. W., U. S. A.—(1bx), (1cg), 1ef, 1fm, 1fd, (1gs), 1hr, 1ii, 1ij, 1il, (1kc), (1kv), (1ky), (1nt), (1pd), 1ql, 1tc, (1um), (1wn), (1wz), 1za, 1zs, (1zk), 1aam, 1aay, 1abf, 1abp, 1adg, 1agg, 1agk, (1ajg), 1all, (1alk), 1alw, 1ana, 1ans, 1aqm, 1ary, 1ate, 1avl, (1axa), 1axr, 1axy, 1bal, (1bbh), 1bcc, (1bch), (1bdx), 1bgq, 1bip, (1bjo), 1bkk, (1blx,) (1bnl), (1bqe), 1bsd, (1btt), (1bub), 1cab, (1ccx), (1cev), 1cjd, (1ckp), 1cme, 1cmx, 1cmy, (1cot), 2bm, 2by, (2cdh), (2cpa), 3ca, (3cf), (3ck). (3dx), 3hh, 3in, 3jo, 3mf, 3na, 3og, 3ot, 3sq, 3tp, 3uy, 3wb, 3wf, (3zd), 3zo, (3ach), 3acr, 3adg, 3adp, 3adt, 3aha, 3mis, 3ajd, 3apl, 3apv, 3arp, 3bco, 3bhy, (3blc), 3bng, 3bof, 3bpf, 3bpp, 3bqp, 3bsf, 3buy, 3ccu, 3cdg, 3cdn, 3cdu, 3cgc, 3cgs, 3chc, 3chg, 3cjn, 3ckj, 4az, 4bq, 4cl, 4eh, 4fz, 4gw, 4io, 4je, 4ke, 4kk, 4ku, (4mb), (4mi), 4pd, 4pk, 4qf, 4qw, 4rr, 4tj, 4vn, 4xe, 5am, 5be, 5bj, 5cn, 5ek, 5hl, 5ka, 5kc, 5lh, (5lu), 5mi, 5ot, 5ox, 5qh, 5ru, 5se, 5uj, 5uk, 5vi, 5vv, 5wi, 5xa, 5aaq, 5aaz, 5abn, (5acm), 5aek, 5agj, (5alz), 5amg, 5apc, 5apv, 5zas, (5zav), 6ac, 6gu, 6lv, 6oi, 6rm, 6rn, 6zp, 6aao, 6adt, 6ahp, 6alv, 6apw, 6arb, 6awt, 6bjj, 6blw, 6bql, 6buf, 6bur, 6cgo, 6cgs, 6cnl, 6cto, 6xad, 6xbw, 7ij, 7mf, 8ab, 8ah, (8ak), 8bn, 8bg, 8cp, 8ef, 8ge, 8gz, (8hn), 8jq, 8nm, 8on, 8or, 8pl, 8qr, 8rg, (8rj), (8sf), (8tt), (8ut), 8uq, 8vq, 8wm, 8wo, (8wz), 8zd, 8ze, 8zz, 8abw, 8acm, 8ada, 8adm, 8agg, 8ago, (8ahq), 8ajn, (8ase), (8atz), 8aum, 8avk, 8axd, (8axg), 8ayu, 8azw, 8bau, 8bbf, 8bbl, 8bbw, (8bdk), 8ben, 8bgo, 8bhj, (8bhu), (8bko), (8blp), (8boe), 8bos, 8boy, 8bpl, (8bqa), 8bqi, (8brb), 8brc, 8brd, 8bsf, 8btf, 8bvr, 8bgb, (8bzk), (8cbm), 8cbp, 8cbx, (8cck), 8ccq, 8ccr, 8ced, (8cej), 8cep, (8cqf), 8cjp, 8cmn, 8coe, 8coj, (8cse), 8cuk, (8czy), (8dae), 8dal, 8dan, 8dat, (8dea), 8dfb, 8dfm, 8dfo, 8dge, 8dgl, (8dgr), 8dhv, 8djf, (8djp), 8dkl, (8dli), (8dme), 8dnf, 8dpk, (8dqw), (8drw), (8dsc), 9at, 9bm, 9dr, 9ej, 9ek, 9es, 9fs, 9hp, 9jh, 9kh, 9lz, (9mn), 9nv, 9ny, (9oa), 9of, 9ud, 9vz, 9za, 9zt, 9aan, 8abn, 9ack, 9acl, (9afi), 9afy, (9ahy), 9akn, (9amx), 9aor, 9asd, 9att, 9auc, 9avb, 9avy, 9awu, 9bcj, 9bds, (9beg), 9bhi, 9biq, 9bji, 9bjr, 9bkr, 9blj, (9bmc), 9bmx, 9bna, 8bnk, 9bob, (9boe), (9bpm), (9buk), 8brx, 9bva, 9bvn, (9bwb), 9bwp, 9caa, (9cbz), 9ccm, 9cdp, 9cee, (9cfc), (9cfi), 9cgn, 9cgs, 9cjc, 9cjm, 9ckb, (9ckh), 9ckl, (9cku), 9ckv, 9clq, 9cpm, 9csn, (9ctf), 9cur, 9cvf, 9cvp, 9cvs, 9cxx, (9cyd), 9cyy, 9dat, (9bh), 9dbp, 9dfh, 9dhp, 9dlh, (9dlj), 9dng, 9doz, 9dpx, 9dqu, 9dsa, 9dtr, (9dtt), 9duc, (9dwx), (9dwz), (9dxl), 9eas, (9edq), 9eeg, 9eel, 9efz, 9egu, 9ehr, 9ehs, (9ehu), 9ehy, 9eji, 9ejy, 9eky, 9ela, 9ell, 9xbg.

CANADA: 1ef, 2ax, 2az, 2bq, 2fo, 3bp, 3kq, 3ly, 3ms, 3ni, (3tf), 3ws, 3wv, 3xi, 4cr, 9bg.

I.C.W.: 3tr, 3cit, 8eb, 8ue, ncg, (nrg).

SPARK: 8tj.

OTHERS: nfv-nkf, g2jf, g2kf, g2nm, g2od, g2sh, g2sz, g6nn, f8ab, m1b, mbx, nz2ac, nz4aa, nz4ag.

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### 9DHJ, CROWN POINT, IND. (1 TUBE)

C. W.: 1abp, 1acs, 1aix, 1aln, 1alw, 1ga, 1gs, 1gt, 2aay, 2akb, 2bm, 2brb, 2akp, 2bye, 2by, 2buy, 2ccv, 2cdn, 2cgx, 2cjb, 2cgb, 2cjx, (2chz), 2cpo, 2cxy, 2cqo, 2cvj, 2cpa, 2dx, 2fk, 2hc, 2iu, 2wz, 3buy, 3bwt, 3cdn, 3cel, 3hd, 3cqz, 3mf, 3ms, 3ot, 3ph, 3pp, 3qf, (3qt), 3tf, 3zm, 4cr, 4fz, 4eb, (4gw), (4dv), 4jr, 4mi, 4pd, 4ou, 4un, (5aek), 5ago, 5afx, 5agv, 5amu, 5amw, 5anl, 5aaq, 5apa, 5agy, 5bb, 5ck, 5ek, 5kr, 5qh, 5qz, 5qy, 5wi, 5se, 5xa, 6afh, 6ano, 6cnf, 7hg. (Eights and nines too numerous.)

I.C.W.: 2rk, (2czr), kdka.

CANADIAN C.W.: 3co, (3ep).

Gld to qse crd to above.

---

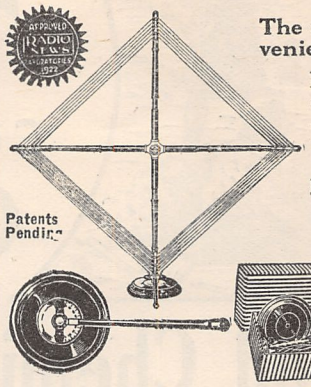
### 9DHJ, CROWN POINT, IND. (One Tube.) (October.)

C.W.: 1abf, 1ajx, 1ams, 1gh, 1re, 1ts, 1zt, 2ah, 2atf, 2by, 2bal, 2bls, 2cj, 2cbg, 2cee, 2cnk, 3aa, 3as, 3ach, 3ahd, 3bco, 3bfe, 3bhv, 3cjn, 3cjw, 3buv, 3bwt, 3bta, 3cdn, 3cel, 3hg, 3kl, 3zo, 4eg, 4fg, 4ft, 4hs, 4io, 4qf, 4si, 4sy, 4un, 5am, 5amh, 5amu, 5amw, 5agj, 5aij 5apc, 5fv, 5ji, 5ka, 5kr, 5er, 5nj, 5qh, 5qz, 5wi, 5zr, 6awt, 6ahd, 6beg, 6bon, 6cgw, 6xad, 7aeb??, 7aip, 7lw.

SPARK: 3zm, 4fg, 4qg, 4so, 4ty?

Gld to qsl to above.


# Duo-Spiral Folding Loop



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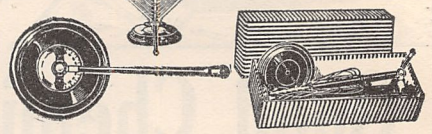
Easily portable

Patents Pending



The favorite loop aerial because of its great convenience, handsome appearance and superior performance. Compact and self contained. The best loop for permanent installations or portable sets. There is a model for every circuit.

Rotates on base which has silvered dial graduated for calibration. Handle permits adjustment without body capacity effect. Direct connection prevents losses. Handsomely finished in silver and mahogany. **Price $8.50**

## TINY-TURN

A better vernier control which makes perfect tuning easy. Gear ratio of 30 to 1. Rotates in same direction as dials. Can be disengaged leaving dials free. Easy to install. Handsome nickel and ebony black finish. **Price 75c**

*If your dealer cannot supply these standard products, write direct.*

## Radio Units Inc.
1300 FIRST AVENUE MAYWOOD, ILL.
Perkins Electric Ltd., Montreal



# M & M 180° Coupler

Both rotor and stator wound on polished bakelite tubing. The rotor consists of 68 turns of No. 23 double silk wire bank wound. The primary consists of 64 turns of No. 23 double silk with eight taps conveniently located. The rotor contacts are positive. Easy control of regeneration is made possible through the 180 degree feature. Used and endorsed by set builders everywhere.

## Price each $2.50

*Our big Radio Catalog is yours for the asking*

## The M & M Co.
500 Prospect Ave., Cleveland, Ohio

**2WZ, 654 EAST 23rd ST., BROOKLYN, N. Y.**
**(October)**

C.W.: 1bc, 1cg, (1cx), 1db, (1dl), 1fd, 1gs, 1gv, 1hn, (1ii), (1kc), (1kx), (1ky), (1lj), 1mo, (1my), 1om, 1ow, (1oz), (1sf), (1sw), 1ve, 1xu, 1xw, 1xz, (1yb), (1yd), 1yk, (1zk), (1zz), 1abf, 1abp, 1aco, 1aez, (1afd), 1agg, 1ahb, 1aid, (1ajg), 1ajw, 1ajx, (1akk), (1alj), (1alk), (1all), 1aml, 1aoc, 1aou, (1aqm), 1are, 1asr, 1atj, 1rvl, 1avp, (1awe), (1awq), (1awy), 1axa, (1axr), 1bip, 1bit, (1biz), (1bjo), (1bjf), 1blx, 1bpb, 1bqq, 1bsd, (1btt), 1bub, 1bvl, (1bvn), (1bwd), 1cab, (1cav), 1ccx, (1ckp), 1cmp, (1cmx), 1cpn, (1cqx), 1cre, 1ctt, 1xam, 1xav, (2bm), (2gk), (2cqj), 3be, 3bg, 3ca, 3du, 3eh, 3hh, (3hq), (3jo), (3kj), (3lg), (3mf), (3og), (3oq), (3qt), 3qw, 3sh, 3ti, 3uy, 3wb, 3wu, (3acy), 3adp, 3ady, (3aeq), 3aha, 3aod, 3aoj, 3asi, (3auv), (3avk), 3bal, 3bdo, 3bfe, 3bhv, 3bmz, 3bqp, 3bsb, 3bva, 3ccw, (3cdn), (3cej), (3cqs), (3chc), (3chg), (3cjn), 3chh, 3ckj, 3ckl, 4ai, 4bq, 4bx, 4ch, 4fs, 4ft, (4hr), (4ir), 4kk, 4mi, 4oa, (4pd), 4qf, 4rf, 4rr, 4ru, 4si, (4tj), 4xe, 5al, 5fv, 5in, 5jf, (5ka), 5mi, 5ph, (5qh), 5tn, 5uk, 5xa, (5aaq), 5acm, 5aex, 5air, 5alj, 5aqr, 5xat, 5zai, 5zas, 6gt, (6gu), 6jp, 6lv, 6rn, 6aab, 6aao, 6adt, 6agk, 6avj, 6awt, 6bjj, 6bka, 6bur, 6buy, 6cfz, 6cgs, 6cgw, 6chx, 6cqe, 6ckx, 6cto, 6xad, 7gq, 7zu, 8ak, (8al), (8dc), 8ef, 8er, 8es, 8fm, (8hp), 8kc, 8ld, (8lo), (8nt), (8ox), 8pl, (8rj), 8se, 8tt, (8uf), 8up, 8ut, 8ve, 8vq, 8wo, 8xb, 8yx, 8zy, 8zz, 8abm, 8acm, 8ada, (8ade), 8add, (8adq), 8aey, 8ago, 8ajf, 8ajh, 8ajn, 8aju, (8ali), 8amq, 8aol, 8apt, 8apu, (8aqp), (8ase), 8atz, (8aub), (8avx), 8baj, 8bau, (8bbf), 8bcp, 8ben, 8bfe, (8bhj), (8bhu), 8bhy, 8bit, 8bjv, (8bjy), 8bkh, (8bko), 8bky, (8blr), 8boa, (8boe), (8bof), (8boq), (8bow), (8boy), 8bpa, 8bpl, 8bpu, (8bqp), 8brc, (8btf), 8bxh, 8bzf, (8ctd), (8ced), (8ces), (8cdf), (8cjp), 8ckl, 8clc, 8cmt, 8coj, (8crv), 8cwp, 8cww, 8cyh, (8cyt), 8czz, (8dah), (8dal), (8dbo), 8dcb, (8dcf), 8dcu, 8dea, 8ded, 8dfm, 8dga, 8dgl, (8dgp), 8dha, (8die), (8dki), 8dmf, 8dmr, 8dnf, 8dnv, (8doq), 8dpk, (8dpn), (8drc), 8drj, 8xbh, 9ab, 9bk, 9ca, 9ep, 9hn, (9hp), 9ii, (9kq), 9lb, (9mc), 9ny, 9pb, 9rt, 9vc, (9xi), 9zw, (9aad), 9aaw, 9acl, 9adp, (9afi), 9afy, (9ahe), 9aod, 9aor, 9aps, 9ars, 9att, 9aur, 9avb, 9aws, 9axt, 9axx, (9bbj), 9bcd, 9bdw, (9beg), 9bez, 9bga, 9bhf, 9bhy, (9bhx), 9bie, 8biq, 9bji, 9bmh, 8bmv, (9bna), 9bnk, 9bob, 9bpo, 9bud, 9bva, 9bxg, 9caa, 9cap, (9cbz), 9cci, 9ccj, 9ceb, 9cgn, 9chd, 9cii, 9cjc, 9clq, (9cnb), (9ctf), (9ctr), 9cuc, 9cuh, 9cur, (9cvs), 9cyk, 9czl, 9dbh, 9del, 9dfg, 9dfq, 9dfv, 9dqu, 9dtk, (9dvi), (9dwx), (9dwz), (9dxn), 9eak, 9eba, 9ech, (9efz), 9ehi, 9ehy, 9eib, (9eji), (9ejy), 9eky, 9eld.

CANADA C.W.: 1ei, 2au, 2ax, 2bn, 2cg, 2fo, 3bi, (3kq), (3ly), 3wg, (3xi), (3zb).

ENGLISH: 2od.

I.C.W.: (c3ol), 1fb, 1xu, (1bwd), 8kx, 8rv, (8tj), (8tr), 8apt, (8ars), (8bhj), 8dat, 9aaw, (ncg).

SPARK: (1si), 1azt, (8tj), (9gx-?), 9zw.

PHONE: (ncg), 8aee, 8afu, 8bit.

SPECIAL C.W.: fje, (nfv), nkf, (ncg).

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**1SF—1ALJ, H. H. JOHNSON, SHORT BEACH, CONN.**
**(OCT. 1 TO NOV. 2)**

U. S. A.—(6age), (6ahp), (6ame), 6apt, (6arb), (6bez), (6bjj), (6bjx), 6bka, 6cax, (6cei), 6cft, 6cfz, 6chl, (6clp), (6fy), (6hp), 6lf, (6of), (7abb), 7gk, (7gr), (7ij).

BRITISH STATIONS—2fn, (2kf), 2nm, (2od), (2sz), 5lf.

MEXICAN STATIONS—(1b).

NEW ZEALAND STATIONS—(2ac). 4ag.

---

**PAUL V. WELLER, 1048 WALNUT STREET, GARDENA, CALIF.**
**(OCT. 12 to 15)**

All calls heard on low waves.

1vb, 1hv, 1gu, 1hw, 1xav, 1hv, 1bk, 1ls, 1haa, 2hw, 2czu, 2wk, 2bd, 3bl, 4lj, 4hr, 5gk, 5aai, 5ay, 5aij, 5ov, 5ame, 5wr, 5wy, 5mi, 5blm, 7fr, 7acy, 7iw, 7ij, 7uv, 8aw, 8fm, 8vq, 8hn, 9bvs, 9cd, 9zd, 9cjk, 9ecu, 9cfy, 9bji, 9ccm, 9ehl, 9ap, 9bm, 9aod, 9ar, 9dyI, (c68, vyqsa, qrh, 86 meters, hrd. abt. 11 p. m. qra?).

Hrd. on high waves (150-200), 2mk, 5uz, 5amo, 5al, 5aj, 5mn, 5lo, 5lh, 5lg; 7dz, 7io, 7ob, 7ajl, 7ok, 7mx, 7om, 7bm, 7wa, 7nx, 7ic, 7hy, 7mu, 7wm, 7vn, 7km, 7ij, 7lw, 7gv, 7akk, 7ii, 7ahs, 7ej, 7mn, 8vl, 8chy, 8bau, 9chl, 9caa, 9cvu, 9cee, 9cl 9bun, 9dhn, 9ado, 9cak, 9alj, 9hl, 9my.

CANADA—4cn, 1bl, 5ga, 5ba, 9bl.

L. B.—Heard 11:30 p. m., October 13, qra?

All cards answered.

---

**9ADO—CLARENCE HAYWARD, 509 NORTH HENRY ST., SAVANNAH, MO.**

C. W.—1bbh, (1bub), 1il, 1apk, 1ql, 1fb, 1kp, 6cef, 6ab, 6ti, 6acu, 6kt, (6cqe), 6akh, 6bnt, 6cdg, 6ctl, 6qi, 6dd, 6afh, 6akz, 6cui, 6afg, (6cgw), 6uf, 6acr, 6cch, 6avj, 6csr, 6ea, 6amo, 6li, 6crx, 6cgv, 6cae, 6ckz, 6bqc, 6aao (6ahp), 7gs, (7gv), 7co, 7mp, 7cw, 7pz, 7nh, 7df, 7sh, (7ald), 7ec, 7au, 7fn, 7mf, 7alk, 7uv, 7akd, (7no), (7ho).

CANADA, C. W.—1ei, 2am, 3ad, 3xi, 4io, 5ah, 5go, (5ba), 9ad.

MEXICO—bx (1e).

HAWAII—6ceu, 6aof, qrz, es qrk.

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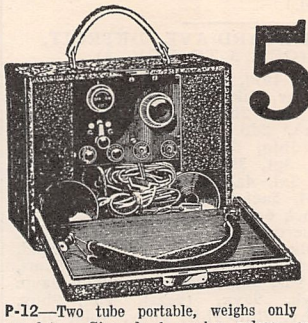
**LOREN BLOCK, REDMISA, COLO. (DET. 2AF) (OCTOBER)**

5apm, 5aqa, 5add, 5ary, 5anl, 5amw, 6abi,


# KODEL For Every Purpose and Any Purse

## 5.00 to 32.50

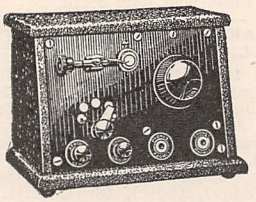


P-12—Two tube portable, weighs only 8 lbs. complete. Gives loud speaker volume on local and many distant stations.

**$22.50**

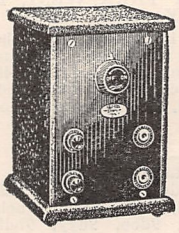
P-11—A one tube portable—the Camera of Radio—fits in the corner of hand bag, weighs only 4¾ lbs. complete.

**$16.00**



C-1—Crystal Receiver. Beautiful, selective long range and simple to operate.

**$5.00**

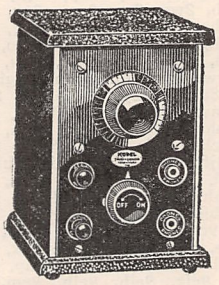


A-11—One tube Audio Amplifier.

**$12.00**

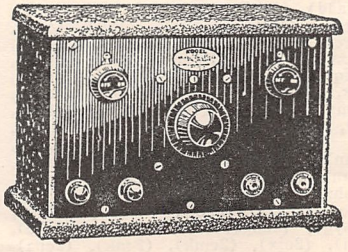
A-12—Two tube Audio Amplifier.

**$17.00**



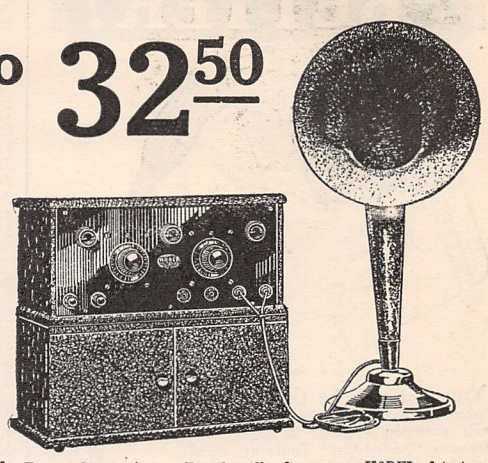
C-11—One tube receiver—Range up to 1,500 Miles.

**$10.00**



C-12—Two tube recevier. A marvel for selectivity, range and volume.

**$18.00**



C-14—Four tube receiver. Tuned radio frequency, KODEL detector, reflex and two stages audio frequency amplification gives six tube volume with only four.

**$32.50**

(Battery cabinet as shown, $4.50.)

## *Radio's Greatest Set Value*

# KODEL

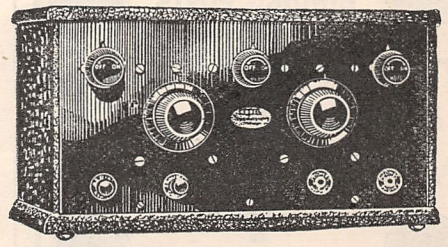
**KODEL is the radio sensation of the season. Priced lower than any other quality set on the market, KODEL performance matches that of the big expensive sets.**

**Think of a four-tube set, with a transcontinental range, with a volume equal to most five-tube sets, selling for $32.50! With tubes, storage battery, charger, loud speaker, everything, costs less than $100!**

**And with all its low prices the KODEL line represents the best in finished workmanship. Fine construction, of best materials obtainable, moulded parts of genuine Bakelite, highly polished Formica panels, cabinet of black pebbled leatherette, battery posts in rear of cabinet. KODEL—the lowest priced GOOD set on the market!**

**See the complete KODEL line at your dealer's—or write for illustrated catalog.**

**THE KODEL MFG. CO.**
**121 West 3rd St., Cincinnati, O.**



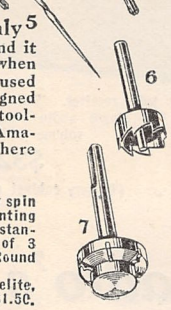
C-13—A three tube KODEL Masterpiece. Tuned radio frequency, KODEL detector, reflex and audio amplification gives five tube volume and range.

**$28.00**

**RADIO'S GREATEST SET VALUE KODEL**

# Build that Set BETTER!

Your set will be thoroughly "professional" in appearance—and it will actually *operate better*—when Stevens "Speed-Up" Tools are used in the making. They're designed just for this work, by expert toolsmiths. Speedy—convenient. Amateurs and professionals everywhere enthusiastic.




1—SPINTITE WRENCHES. They spin the little nuts on TIGHT, preventing leaks. High grade tools—substantially built for service. Set of 3 most popular sizes for Hex or Round nuts, in box, $1.00.
2—UTILITY REAMER, for bakelite, rubber, etc. Size 1/8 to 1/2 in., $1.50. Size 3/8 to 3/4 in., $2.00.
3—OVERSIZE REAMER, for "tight" dials, jacks, etc. In two sizes, 3/16 and 1/4 in., each 75c.
4—COMBINED DRILL AND COUNTERSINK, 35c.
5—RADIO SCRIBER, length 6 3/4", 45c.
6—PANEL CUTTERS, for bakelite, rubber, etc. Size 3/4 in., 75c; 1 in., 85c; 1 1/2 in., $1.00.
7—BEZEL BEADER, forms beautiful beaded finish in panel holes. Size 3/4 in., $1.75; 1 in., $2.00.
8—ADJUSTABLE PANEL CUTTER, for 1 1/2 to 6 in. holes, $1.75.
9—REAMAWL, for starting screws, laying out panels, etc., 35c.
10—SCREW CLAMP, for holding screws while filing to size, etc., $1.50.
11—SPEED-A-LOOP PLIERS for forming perfect loops in bus bar or wires. Complete $1.50. Attachment only, 50c.

*Ask your dealer for these useful tools; if he can't supply you write us direct. Booklet 24 free on request.*

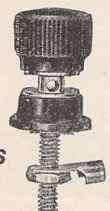
**Stevens & Co.**
Toolsmiths since 1899
375 B'way, New York

**Stevens SPEED UP Tools for RADIO**



ANT | SPEAKER + | SPEAKER − | A BAT +
LONG ANT | A BAT −

**EBY**
**BINDING POSTS**



*Twenty-five Different Engraved Tops* — *They Don't Lose Their Heads*

INPUT | B AMP +
A+ BAT B− | + | − | B DET +

Sold by dealers everywhere
**H. H. EBY MFG. CO.**
PHILADELPHIA


6acn, 6amp, 6bcn, 6cfs, 6rf, 9aml, 9amp, 9asy, 9bbq, 9dad, 9dbr, 9cof, 9bv, 9bhk, 5afb, 6adm, 6ur, 8hw, 9bvk, 9cmp, 9dad, 9wo, 9djp.

FONE—5alw, 5ams, 5amw, 9aj, 9cap, 9cfi, 9cfd, 9dav, 9daj, (9dq), 9ju, 9ua.

(All QSL's from Loren answered. Sig. strength and mod. reported.)

### 8CRL—2145 HIBBARD AVE., DETROIT, MICH. (OCT. 3 TO NOV. 3)

1acj, 1ahb, 1ahs, 1ajq, 1akz, 1alk, 1aqk, 1awq, 1cav, 1caz, 1fn, 1cv, 1ik, 1rs, 2acs, 2adn, 2acq, 2aks, 2be, 2bkk, 2bq, 2bv, 2bvq, 2by, 2cj, 2cl, 2ctq, 2cui, (2czr), 2do, 2lq, 2xi, 3asy, 3ahp, 3ape, 3avj, 3az, 3bfq, 3bo, (3buv), 3cd, 3cdn, 3chq, 3cko, 3wp, 3gt, 3hq, 3hr, 3kq, 3hy, 3pp, 3sp, 3uz, (3uy), 3xi, 4ahy, 4chr, 4eo, 4cq, 4ft, 4fv, 4ga, 4hr, 4vi, 5acf, 5aex, 5ahs, 5ajn, 5ake, 5hqq, 5nj, 5vy, 6bcl, 6awf, 6zv, 7bt, 7zu.

Eights too numerous.

9aax, 9acu, 9adk, 9aef, 9afe, 9aje, 9ajz, 9akd, 9akx, 9aky, 9alk, 9alz, (9aiz), 9amn, 9amp, 9ams, 9arb, 9arw, 9ars, 9as, 9asu, 9atx, 9uj, 9avi, 9aup, 9avx, 9awu, 9ayk, 9ayx, (9azl), 9bb, 9bby, 9bbz, (9bhb), 9bby, 9bjf, 9bjz, 9bkv, 9blg, 9blq, 9bls, 9bob, 9boy, 9bqr, 9bsq, 9btk, 9bun, (9hvu), (9vuv), 9bxa, 9ub, 9cbi, 9ce, 9cep, 9cfk, 9ogn, 9cke, 9ckf, 9ckh, 9ckn, 9crl, 9cvf, 9cvz, 9xq, 9cyd, 9czb, 9ddk, 9dcc, 9deq, (9dgh), 9dhr, 9dho, 9dhv, 9dhy, 9dih, 9dko, 9dlw, 9dmq, 9dhn, 9dwq, 9dlw, 9dmq, 9dwn, 9dwo, 9doz, 9drs, 9duy, 9dvy, 9dwy, 9dww, 9eac, 9eas, 9ei, 9ej, 9eji, 9cjv, 9ckm, 9cky, 9cmd, 9eb, 9exc, 9eyi, 9cil, 9ii, 9lc, 9sk, 9tg, 9tw, 9ww, 9wy.

Gld to KSL to those who send a crd.

### 9APY—3337 OAK PARK AVE., BERWYN, ILL. (OCTOBER)

C. W.—(1ajw), 1avl, (1axa), 1bet, 1biz, 1cmp, 1db, 1cz, 1hn, 1my, 1om, (2agq), 2bqh, 2buy, (2bzj), 2cbk, (2chu), (2gl), 2co-, 2cpx), (2ctq), (2cty), 2cv, 2wz, 3aha, 3do, (3ti), 4gw, 4hr, 4jr, 4si, 5acb, 5aef, 5aeq, 5afv, 5akn, (5akp), 5akw, 5amw, 5aqw, 5cg, 5ck, 5nt, 5qk, 5tx, 5ua, 7cf, 8aly, 8boy, 8bpn, 8bqp, (8brc), 8cmt, (8cse), (8cuk), (8dga), (8dqv), (8dsc), (8rh), (8rj).

SPARK—U-5gg.

CANADIAN—C-3vh.

U. S. FONES—2iu, 2rq, 3xan, 5amf, 8brc.

A crd awaits every QSL. QRK?

### 2EQ—75 PROSPECT PARK WEST, BROOKLYN, N. Y. (OCTOBER)

1bal, 1aap, 1aou, 1xz, 1ajb, 1fb, 1bcj, 1aw, 1bep, 3bhv, 3uy, 3lg, 3oq, 3cdv, 3ga, 3mf, 3chg, 3dk, 4si, 4db, 4eq, 4mi, 4pd, 4ku, 4ai, 4hw, 5uk, 5ac, 5sl, 8bu, 8dnp, 8clc, 8buk, 8boy, 8cmf, 8cao, 8dbm, 8dnf, 8dln, 8ali, 8up, 8bu, 9eji, 9cof, 9bre, 9caa, 9cfi.

CANADIAN—2ax, 3fc.

### 1NT—ATTLEBORO, MASS.

8nz, 8kw, 8bzf, 8dc, 8dgl, 8atr, 8diz, 8ajk, 8dcv, 8bll, 8cci, 8blt, 8ale, 8aam, 9bcb, 9arm, 9th 9ca, 9dhg, 9bhi, 9dcp, 9dyy, 9bdb, 9bhz, 9auc, 9dmi, 9ado, 9dvi, 9amx, 9and, 9caj, 9ejy, 9ccj, 9aaq, 8clx, 9cee, 9rt, 5ox, 5se, 5aiy, 5ek, 5apc.

### C-3BL—1331 AVENUE ROAD, TORONTO, ONTARIO (AUG. 4 TO OCT. 14)

U. S.—1abf, 1ajg, 1ali, 1arf, 1bit, 1bjo, 1cph, 1cue, 1db, 1fd 1gk, 1xaf, 2ad, 2cap, 3cgi, 2cnx, 2crp, 2crw, 2gk, 2rb, 2wz, 2zx, 3ary, 3av, 3bez, 3bhu, 3bof, 3bta, 3buy, 3cdk, 3cgc, 3chg, 3ckl, 3fc, 3fr, 3hd, 3kl, 3lg, 3mf, 3os, 3xd, 3zo, 4dy, 4gw, 4si, 5aaq, 5fs, 5gn, 5ka, 5ox, 5qh, 5uk, 5ux, 5vv, 6cdr, 6cgw, 6cto, 6ne, 6rn, 7agi, 7sl, 8abm, 8acn, 8acy, 8ada, 8aey, 8ah, 8ali, 8amq, 8ams, 8aq, 8aub, 8avx, 8axf, 8axn, 8ben, 8beu, 8bfe, 8bfo, 8bg, 8bhu, 8bjz, 8bmb, 8bna, 8btf, 8bvr, 8cdc, 8chb, 8chy, 8cjp, 8cpk, 8con, 8cwu, 8dgo, 8dgp, 8dja, 8djf, 8dkm, 8dla, 8dln, 8hf, 8ic, 8jq, 8nh, 8nm, 8pl, 8th, 8uf, 8ur, 8ux, 8up, 9ach, 9ag, 9agl, 9ahe, 9aqu, 9arf, 9avb, 9avk, 9ayo, 9beg, 9bhb, 9big, 9bmk, 9bna, 9bob, 9btk, 9but, 9bvm, 9bye, 9ccw, 9ced, 9cee, 9cei, 9cfi, 9cfk, 9cfs, 9ch, 9cks, 9crr, 9cta, 9cur, 9cx, 9dbf, 9dbj, 9dfq, 9djd, 9dlc, 9dmi, 9dnk, 9dnp, 9drx, 9dsx, 9dwy, 9dxy, 9efz, 9eib, 9elb, 9em, 9es, 9fb, 9hk, 9jt, 9lz, 9nl, 9ny, 9pq, 9rx, 9ta, 9ze, 9zt, 9wx—WGH, WWV.

### 9BIQ EX 9DEK—NORTH JUDSON, IND. (OCTOBER)

C. W.—(1aad), (1abf), (1adn), (1aea), (1aez), (1afn), (1agg), (1aji), (1akz), (1all), 1aou), (1apc), (1are), (1arf), (1atj), (1avp), (1awq), (1aww), (1axz), (1azb), (1ban), (1bcu), (1bdx), (1bep), (1bfq), (1bgq), (1bie), (1biz), 1bkk, (1bkr), 1blx, (1boa), (1bqe), (1bqi), (1cab), (1caz), (1cmx), (1ah), (1cg), (1fd), (1hn), (1iv), (1kc), 1on, 1oz, (1pe), 1py, 1se, (1ts), (1vc), 1xw, (1xav), (1xaw), (1yb), (1zac), (2aar), (2aan), (2aaz), (2abt), 2acd, (2ach), (2acs), (2adm), (2adu), (2agb), (2agq), (2aoy), (2anm), (2bbx), (2bck), 2bco, 2bdl, (2beo), (2bgg), 2bjo, (2bkr), (2boi), (2bqb), (2brb), (2bxw), (2byg), (2cbg), 2cei, (2cgb), (2chc), (2chz), (2cji), (2cjx), (2cmk), (2cnk), (2cpa), (2cpk), (2cpx), (2crp), 2cqz, (2ctn), (2cty), (2ctq), (2cvu), (2cxe), (2cxy), (2cyx), 2cyw, (2czr), (2ag), (2al), (2bm), (2fo), (2gk), (2kk), (2kx), (2mc), 2rk, (Icw), (2sy), (2wz), 2xbf), (3abw), (3adv), (3afs), 3age, (3agf), (3ahs), (3aih), (3aoy), (3auv), (3avk), (3awu), (3bay), (3bdo), (3bhv), (3blc), (3bof), (3bsf), (3btq), (3buy), (3bva), (3cbl), (3ccw), (3cdk), (3cdg),

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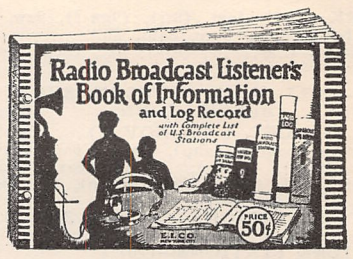
(Mfd. under U. S. Pats. No. 1,185,987, 1,272,843. Other patents pending.)



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**Information for the Broadcast Listener:**
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CANADIAN—1ef, (1ei), 2ax, (2bg), (2fo), 3ad, (3co), (3fg), (3gv), (3he), (3kq), 3kx, (3ly), 4aa, 4dy, 4cr, 4hs, 5ba, 5go.

NAVAL—(nkf), (nfv), wgh, wwv.

ITALIAN IHT—10 watts on 80 meters here.

2CRP—23 EAST 34TH ST., BAYONNE, N. J. 4aa, 4ch, 4gh, 4gv, 4kk, 4my, 4pv, 4sa, 4sh, 4si, 4tj, 4un, 4xe, 4yy, 5acm, 5aeq, 5aex, 5ajj, 5ajn, 5akn, 5alz, 5amw, 5apc, 5apj, 5aqy, 5ari, 5bz, 5nt, 5ue, 5uj, 5xa, 6cgw, 6ct, 9aao, 9aaw, 9ado, 9afi, 9agz, 9ahj, 9aid, 9aii, 9aob, 9aqu, 9arz, 9ato, 9auc, 9avb, 9awf, 9ayd, 9ayi, 9bav, 9bbm, 9bcd, 9bcf, 9bdu, 9beg, 9beq, 9biz, (9bfb fone), 9bhj, 9bij, 9bjz, 9bkm, 9bna, 9bnk, 9bob, 9bop, 9bqi, 8bqj, 9bvh, 9bvz, 9ca, 9cci, 9cco, 9ccs, 9cdp, 9ceb, 9cee, 9cep, 9cgr, 9chg, 9cgn, 9ckb, 9clk, 9coc, 9cov, 9cp, 9cpr, 9cro, 9crp, 9csg, 9ct, 9cur, 9dau, 9dcw, 9deq, 9dhg, 9dhl, 9djn, 9dlc, 9dlj, 9dl, dwh, dmi, 9dnn, 9dno, 9dsa, 9dtt, 9duj, 9duz, 9dyt, 9eas, 9efz, 9eib, 9eji, 9ejr, 9ejy, 9emd, 9ex, 9nv, 9pb, 9qr, 9rt, 9su, 9tf, 9up, 9vc, vdm, wgh, iht.

Glad to KSL. PSM QRK? 2CRP.

## LIST OF NEW ZEALAND AMATEUR STATIONS

We present a full list, right up to date, of amateur stations in New Zealand. Except where otherwise stated, the times mentioned are New Zealand time, one hour and a half ahead of Sydney, Melbourne, and Brisbane time.

1AA C. N. Edwards, 42 Pollen Street, Grey Lynn, Auckland, N.Z. 160, 170, 180 meters. Transmits 6 p.m. to 7 p.m., 9 p.m. to 12 p.m.

1AB Penny, No. 11 Peary Road, Mt. Eden, Auckland, N.Z. 140 to 180. Transmits C.W., I.C.W., 6 p.m. to 7; Tuesdays, Thursdays, and Saturdays, 6—12 p.m.

1AC L. S. Spackman, 10 Ardmore Road, Ponsonby, Auckland. 155, 165, 175 meters. Transmits C. W., buzzer, modn., telephony, any and all times.

1AH Hartle and Gray, Hall Commerce, High Street, Auckland, N.Z. 155, 165, 175 meters. Transmits C.W., I.C.W., phone Monday, Wednesday, Saturday, 8—10.45.

1AI Charles Siever Goodwill, Hamilton. 140 meters. (No particulars.)

1AK Claxton, William Harry, Parawai Road, Thames. 140 meters. Transmits C.W. and T.C.W., 8 to 10.30 p.m.

1AM Hamilton Amateur Radio Club, Hamilton. 155, 165, 175. (No particulars.)

1AO Russell Garland White, 125 Grafton Road Auckland, N.Z. 130 to 190 meters (now using 140 meters). Transmits C.W., I.C.W., and phone, 6 p.m. to 7 p.m. week days, and 6 p.m. to 1 a.m. Saturday, Sunday, and Monday nights.

1AQ Aymer Alexander Sommerville, Thames. 140 meters. (No particulars.)

1AR Frank Beesley Hobbs, 44 Le Arota Street, Claudelands, Hamilton, N.Z. 140 meters. Transmits C.W., I.C.W., telephony, most evenings between 6 p.m. and 10.30 p.m.

1AS Ralph Eric Grainger, 88 Clarence Street, Ponsonby, Auckland, N.Z. 130 meters. Transmits C.W., I.C.W., tonic train, telephony.

1AU Rofl Ernest Lempriere Aubin, Auckland. 140 meters. (No particulars.)

1AV Rolf Ernest Lampriere Aubin, "The Oaks," Parnell, Auckland, N.Z. 140 meters. Transmits C.W., I.C.W., tonic train, telephony.

1AW Robert Maxted, Queen Street, Thames, N.Z. 180 meters. Transmits C.W., I.C.W., tonic train, telephony, 6 p.m. to 12 p.m. Only at Xmas vacation, i.e., December 1—March 1. Present address, Canterbury College, Christchurch.

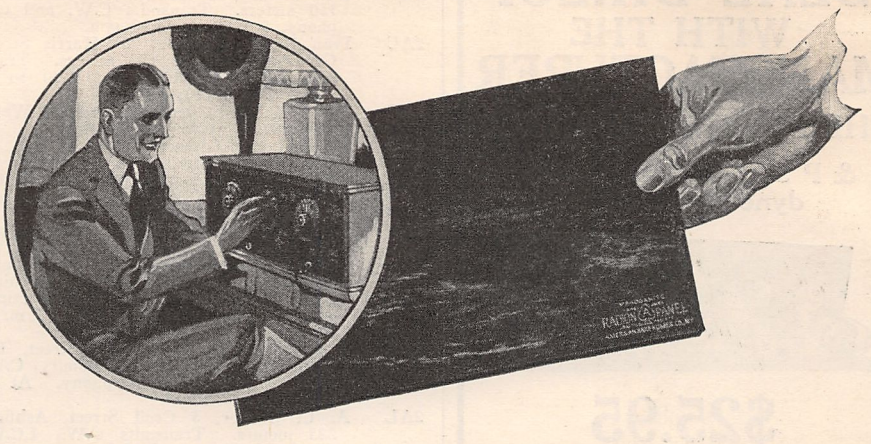
1AZ James Reginald Therson, 17 Te Aroha Street, Claudelands, Hamilton. 140 meters. Transmits C. W., telephony, 6 p.m to 7 p.m., 9 p.m. to 11.30 p.m.

1FC Robert Fred Douglas Burrell, Auckland. 160, 170, 180. (No particulars.)

1FF Vincent John Williams, 45 Valley Road, Mt. Eden, Auckland. 140 meters. Transmits C.W., I.C.W., and 'phone.

1FH James Steel, Auckland. 140 meters. (No particulars.)

1FI Herbert W. Batty, 22 York Street, Parnell, Auckland. 140 meters. Transmits C.W., I.C.W., and 'phone, 6.30 p.m. to 11 p.m.

# Surface leakage exceptionally low with this panel —*built to order for radio*

THE needs of radio are *special.* Better results have invariably followed the use of apparatus and material designed for its own unique demands.

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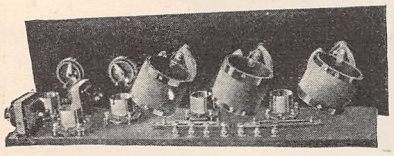

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**is exceptionally low for this high quality outfit.**

This kit consists of all parts necessary to build a five tube Neutrodyne set, including drilled and engraved panel. Coils are wound on finest grade bakelite with silk wire. There is nothing omitted that is necessary to build this set in best working condition.

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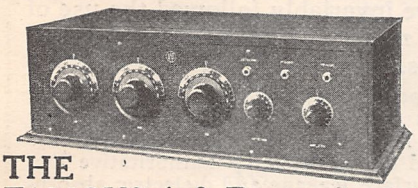

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between 10 and 11 P.M. November 25th, with a 3 tube set using dry cell tubes. They played "June Night" at 10:20 P.M. and "Song of Love" at 10:42 P.M. Central Standard Time.

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| | |
|---|---|
| 1FJ | George Henry Choules, Waiku. 140 meters. (No particulars.) |
| 2AB | Dan Wilkinson, Motueka, N.Z. 125 to 150 meters. Transmits C.W. and telephony, 9 p.m. to 11.30 p.m. |
| 2AC | Ivan Henry O'Meara, 209 Harris Street, Gisborne. 130 to 190 meters. Transmits C.W. and telephony, 6.30 to 12 (Greenwich time). |
| 2AC | Percy Ronald Stevens, Gisborne. 5 Watts, 140 meters. (No particulars.) |
| 2AE | Robert James, Gisborne. 140 meters. |
| 2AI | Walter Leslie Harrison, 47 Austin Street, Wellington, N.Z. 60-140 meters. Transmits C.W., I.C.W., tonic train, telephony, 6.30 p.m. to 11 p.m. |
| 2AJ | Henry Bransgrove, Broadway, Stratford. 140 meters. Transmits C.W., I.C.W., tonic train, telephony. At present only (telephony) music. Sunday evenings from 8 p.m. to 10 p.m., and sometimes on Thursday evenings from 8 p.m. to 10 p.m. |
| 2AK | Leslie Rowson, 99 Victoria Street, Hawera. 140 meters. Transmits C.W., I.C.W., tonic train, telephony. At intervals every night. |
| 2AL | A. C. Cooper, 3 Cecil Street, Ashfield. 225 meters. Transmits C.W., I.C.W., telephony, 10 p.m. to 12 midnight. |
| 2AM | Dr. William Fred Buist, Hawera. 180 meters. (No particulars.) |
| 2AO | Gordon Albert John Brunette, Club Hotel, Opunake. 100 meters. Transmits C.W. and telephony, from 8 till 12 p.m. on ordinary nights, and during daytime on holidays. |
| 2AP | Percy Charles Collier, 17 Taft Street, Brooklyn, Wellington. 140 meters. Transmits C.W., I.C.W., by chopper and fone, most any evening between 6.30 and 10.30 p.m. |
| 2AQ | Morton Wm. Coutts, Box 26, Taihape. 155, 165, 176 meters. Transmits C.W., I.C.W., telephony, 8 p.m. to 10.30 p.m. |
| 2AR | Thomas R. Clarkson, 304 Nelson Street, Hastings. 110 meters and 140 meters. Transmits normal transmissions pure D.C., C.W., also phone and I.C.W., 6 p.m. to 7 p.m., and 8 p.m. to 10.30 p.m. |
| 2AS | Albert Edward Simpson, Wellington. 160 meters. (No particulars.) |
| 2AU | Ian J. Innes, Radio Road, Nelson. 160, 170, and 180 meters. Transmits C.W. and I.C.W. |
| 2AW | Cecil Roy Clarke, 60 Edinburgh Terrace, Wellington. 120 to 140 meters. Transmits C.W., I.C.W., tonic train, and telephony, 8 p.m. till 2 a.m. |
| 2BC | Eric William Beale, Hastings. 140 meters. (No particulars.) |
| 2BF | The Wilkins and Field Hardware Co. Ltd., Nelson. 160 meters. (No particulars.) |
| 2BH | Paul Bareham, 213 Nelson Street, Hastings. 140 meters. Transmits C.W., I.C.W., and 'phone, Saturday 8—12, week nights 6—7 o'clock and 8—9 o'clock. |
| 2BI | Harry Neville Shrimpton, Brookside, Nelson. 140 meters. Transmits C.W., I.C.W., every evening 6.30 to 7 p.m., Mondays, Tuesdays, Thursdays, Fridays 8.30 to 10 p.m., Wednesdays, Saturdays, Sundays 8 to 11 p.m. |
| 2BJ | Allan Evans, Wellington. 140 meters. (No particulars.) |
| 2BL | Wellington College Radio Club, Wellington, 140 meters. (No particulars.) |
| 2BO | Ercel Mervyn Goffe, Gisborne. 140 meters. (No particulars.) |
| 2BQ | Edmund Dobel Edmunston, Napier. 140 meters. (No particulars.) |
| 2BR | Kenneth Arundel Lambert, Wanganui. 140 meters. (No particulars.) |
| 2XB | Physics Dept., Victoria University College, Wellington. 60 to 140 and 395 meters. Transmits C.W., I.C.W., tonic train, telephony. No fixed times, but generally between 7 p.m. and 11 p.m. |
| 2YM | Gisborne Radio Co., Gisborne. |
| 3AA | Reginald John Orbell, Christchurch. 175 meters. (No particulars.) |
| 3AB | Francis Vincent, Christchurch. 175 meters. (No particulars.) |
| 3AC | Radio Society of Christchurch, 158 Manchester Street, Christchurch. (No particulars.) |
| 3AD | Blake, R. G. F., Blaketown, Greymouth. 140 to 180 meters. Transmits C.W., I.C.W., telephony, 8 p.m. to 11.30 p.m. |
| 3AF | Leonard Francis Ball, 90 Nursery Road, Linwood, Christchurch. 130 to 185 meters, also sometimes from 100 to 130. Transmits C.W., I.C.W., tonic train, telephony, nightly from 6.45 till 7 p.m., and 8 p.m till 10 p.m. |
| 3AH | Henry B. Courtis, 69 Grey Road, Timaru. 140 meters. Transmits C.W., I.C.W., 10 p.m. till 11 p.m. |
| 3AK | Ernest Reynolds, Ashburton. 140 meters. (No particulars.) |
| 3AL | Wilfred Milne Dawson, 263 Wills Street, Ashburton. 140 meters. Transmits C.W. and I.C.W., telephony, 6 p.m. to 7 p.m. every night, 8 p.m. to 9.30 p.m. Tuesdays, Wednesdays, Fridays and Sundays. |

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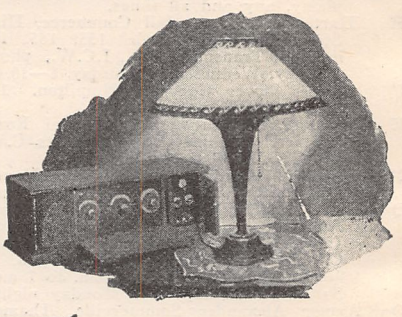

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(124)

| | |
|---|---|
| 3AM | Bernard Tyndall Withers, Christchurch. 180 meters. (No particulars.) |
| 3AR | David Wm. Buchanan, 74 Wills Street, Ashburton. 160, 170, and 180 meters. Transmits C.W. at present 8.30 till 10 p.m. |
| 3AS | Ian James McLean Paterson, Timaru. 140 meters. (No particulars.) |
| 3CA | H. W. Lavallin-Puxley, Farmleigh, Ealing. 140 meters. Transmits I.C.W. and telephony, 8 till 10 every night. |
| 3CB | Clyde Romer Hughes Taylor, 45 Weston Road, St. Albans, Christchurch. 170 meters. Transmits C.W., I.C.W., and telephony, usually after 10 p.m. on week days and 8—12 week-ends. |
| 3CF | Albert E. H. Simpson, 99 Amberley Road, Christchurch. 160, 170, 180. Transmits C.W., I.C.W., and telephony, 7 p.m. to midnight. |
| 3CG | Harold Phillip Vincent Brown, Christchurch. 140 meters. (No particulars.) |
| 4AA | Frank D. Bell, Palmerston South. 120 to 180 meters. Transmits I.C.W. or voice for local and C.W. for D.X. work, week nights 8—11 p.m., N.Z. time, and till all hours Saturday and Sunday nights. Usually calls C.Q. on 170 meters midnight Saturday. |
| 4AB | Otago Radio Association Incorp., P.O. Box 660, Dunedin. 180 meters (concession 300 meters.) Transmits telephony and I.C.W., Tuesday and Friday evenings 8 to 10 p.m., Sundays 2.30 to 4.30 p.m. |
| 4AC | Robert Edward Robinson, Dunedin. 175 meters. (No particulars.) |
| 4AD | Arthur Edward Jordan, 17 Biggar Street, Invercargill. 175 to 180 meters. Transmits C.W. and telephony, 6.30 p.m. to 11 p.m. every night. |
| 4AG | Ralph Slade, 15 Harbour Terrace, Dunedin. 140 meters. Transmits C.W. (A.C.), C.W., and sometimes fone and buzzer modulated, intermittently from 6 p.m. to midnight, and after if necessary. |
| 4AH | Ian Sinclair Macdonald, 45 Royal Terrace, Dunedin. 140 meters. Transmits C.W., I.C.W., and telephony, any time. |
| 4AJ | Claude Norman Douglas McGregor, 131 Engleton Road, Mornington, Dunedin. 140 meters normally. Transmits mostly telephony, occasionally I.C.W., fairly regularly on Thursday evenings at 8 o'clock. |
| 4AK | William L. Shile, Post Office Box 519, Dunedin. 130 to 180 meters. Transmits C.W. and I.C.W., phone, dark to midnight. |
| 4AL | Arnold Henry McLeod Crubb, 53 Sligo Terrace, Roslyn, Dunedin. 155 meters. Transmits C.W. and phone. |
| 4AM | William McGill, Crockett, Palmerston. 140 meters (and lower). Transmits C.W., I.C.W., and fone, 6.30 p.m. until midnight, or later by arrangement; Saturday from 6.30 p.m. till Sunday 4 a.m. |
| 4AO | Thomas Edward Scott, Dunedin. 140 meters. (No particulars.) |
| 4AP | Invercargil Amateur Radio Club, Hallenstein's Buildings, Invercargill. 170 to 190 meters. Transmits C.W., I.C.W., and telephony . |
| 4AR | W. Grey Wilkinson, 21 Melrose Street, Rosedin. Transmits C.W. and telephony nightly N.Z. M.T. |
| 4XO | Professor Robert Jack (for University of Otago), Dunedin. 395 meters. (No particulars.) |
| 4YA | British Electrical and Engineering Co., Dunedin. 370 meters. (No particulars.) |
| 4YO | Radio Supply Co., Dunedin. 370 meters. (No particulars.) |

## LIST OF FRENCH AMATEUR STATIONS

| | |
|---|---|
| 8AA | Riss, 38 *bis,* boul. St-Beuve, Boulogne-sur-Mer. |
| 8AB | Deloy, 55, boul. du Mont-Boron, Nice. |
| 8AC | Alagier, 4, rue Bel-Air, Marseille. |
| 8AD | Roussel, 12, rue Hoche, Juvisy-sur-Orge. |
| 8AE | Dr. Corret, 97, rue Royale, Versailles. |
| 8Aé | Revue "La T. S. F. Moderne," 11, avenue de Saxe, Paris. |
| 8AF | Radio-Club de France, 95, rue de Monceau, Paris. |
| 8AG | Colmant, 16, avenue de Robinson, Châtenay-par-Sceaux (Seine). |
| 8AH | Coze, 7, rue Lalo, Paris. |
| 8AI | Gaumont, 12, rue Carducci, Paris. |
| 8AJ | Société Française Radio-Electrique, 79, boul. Haussmann, Paris. |
| 8AK | Schrœder, 28, rue Lauriston, Paris. |
| 8AL | Gody, quai des Marais, Amboise. |
| 8AM | Lemonnier, 13, allée Gambetta, Marseille. |
| 8AN | Mountaillier, 6, rue Ravignan, Paris. |
| 8AO | Lardry, 71, boulevard Négrier, Le Mans. |
| 8AP | Peugeot, Sous-Roche, Audincourt (Doubs). |
| 8AQ | Sassi, rue Marcellin-Berthelot. Arpajon, |
| 8AR | Dr. Tanier, 81, boul. Notre-Dame, Marseille. |
| 8AS | Coisy, 76 *bis,* av. du Chemin-de-Fer, à Rueil. |
| 8AT | Proviseur Lycée du Parc, à Lyon. |
| 8AU | Barrelier, 22 rue de la Paille, Le Mans. |


# Type 6-D Broadcast Receiver

*Non-oscillating ~ Non-radiating*

IN dollar-for-dollar value, the 6-D Receiver leads the field.

This remarkable Receiver excels in every phase of performance—purity of tone, sharpness of tuning, range, volume and ease of operation.

You can pay more, but you cannot buy better reception. By all means, examine the 6-D before making a final selection.

**Price $125.00**
**without accessories**

EISEMANN MAGNETO CORPORATION
165 Broadway, New York
DETROIT SAN FRANCISCO CHICAGO

SPECIFICATIONS

*Circuit:* Two stages of tuned radio frequency amplification, detector and two stages of audio frequency amplification. Non-oscillating.

*Tubes:* Five in all. Jacks provided for either five or four tube operation.

*Batteries:* Either storage or dry-cells.

*Cables:* Complete set supplied for "A" and "B" batteries.

*Wave lengths:* 200 to 600 meters, with uniform efficiency of reception.

*Aerial:* 75 to 125 feet, single wire.

*Panel:* Aluminum, with attractive crystal black finish. A perfect body capacity shield.

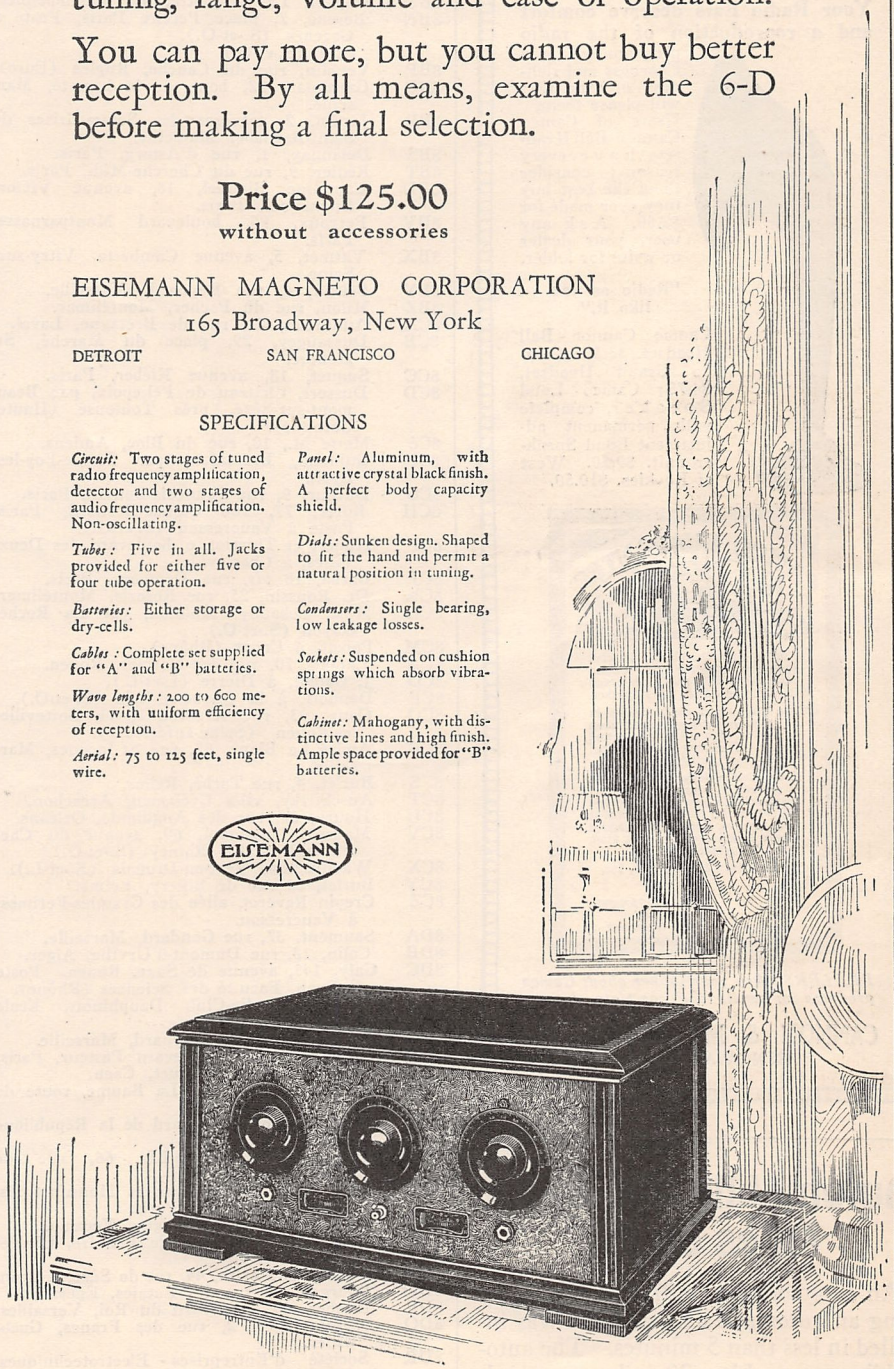
*Dials:* Sunken design. Shaped to fit the hand and permit a natural position in tuning.

*Condensers:* Single bearing, low leakage losses.

*Sockets:* Suspended on cushion springs which absorb vibrations.

*Cabinet:* Mahogany, with distinctive lines and high finish. Ample space provided for "B" batteries.

EISEMANN



EISEMANN
ELECTRICAL EQUIPMENT

APPROVED RADIO NEWS LABORATORY 1925

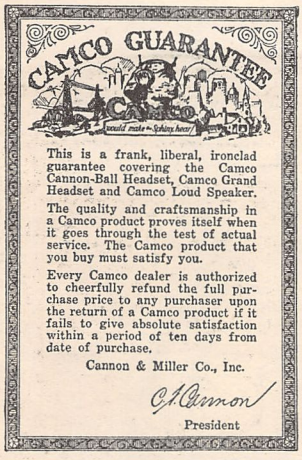
**Cannon-Ball Headset**

**$3.50**

**Your Radio Ears deserve comfort and a reproduction of the radio** program with a clearness and richness of tone that will please them. Users of Camco Cannon-Ball Headsets have every reason to consider them the best buy they ever made for $3.50. Ask any user, your dealer or write for folder.

**"Radio as you like it."**

Camco Cannon-Ball Headset, $3.50; Camco Grand Headset, $4.75; Camco Loud Speaker, complete with permanent adjustment Loud Speaker unit, $9.50. West of Rockies, $10.50.




This is a frank, liberal, ironclad guarantee covering the Camco Cannon-Ball Headset, Camco Grand Headset and Camco Loud Speaker.

The quality and craftsmanship in a Camco product proves itself when it goes through the test of actual service. The Camco product that you buy must satisfy you.

Every Camco dealer is authorized to cheerfully refund the full purchase price to any purchaser upon the return of a Camco product if it fails to give absolute satisfaction within a period of ten days from date of purchase.

Cannon & Miller Co., Inc.

C. A. Cannon

President

*DEALERS: Ask your jobber about Camco products or write for complete details.*

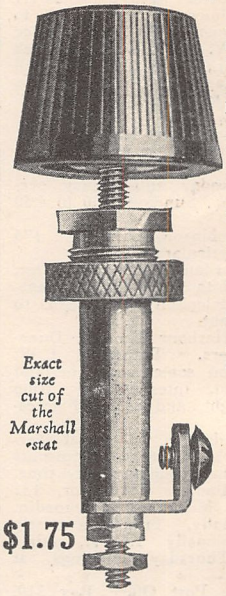
**CANNON & MILLER CO., Inc.**
SPRINGWATER, N. Y.


## Automobile Makes 27 Miles on Air

An automobile goes 27 miles on air by using an automatic device which was installed in less than 5 minutes. The automobile was making 30 miles on a gallon of gasoline but after this remarkable invention was installed, it made better than 57. The inventor, Mr. J. A. Stransky, 4561 Eleventh Street, Pukwana, South Dakota, wants agents and is willing to send a sample at his own risk. Write him today.—Adv.

8AV Voos, 20, rue Werlé, à Reims.
8AX Martin, 17, rue du Maréchal-Soult, Alger.
8AY Thuillier, 13, rue d'Ornans, Alger.
8AZ Vuibert, 7, rue de Vitry, Savigny-sur-Orge (S.-et-O.).
8BA Michielsens, 35, passage Jouffroy, Paris, 0 à 200 m. — 24 à 10 h., 15 à 16 h.
8BB Laborie, 69, avenue de la Grande-Armée, Paris.
8BC Druelle, 6, rue des Domeliers, Compiègne.
8BD Dubois, 211, boulevard Saint-Germain, Paris.
8Bé Deslis, 24, rue d'Illiers, Orléans.
8BF Louis, 8, rue de la Mouliière Orléans.
8BG Horguelin, Nuisement (Marne).
8BH Courtecuisse, Socié.é Tourcoing-Radio, 10, rue de Gand, Tourcoing (Nord).
8BI Laporte, 61, rue Letellier, Paris.
8BJ Vincent, 50, passage du Havre, Paris.
8BK Voisembert, 27, rue Jean-Binet, à Colombes (Seine).
8BL L'Ecole Polytechnique, 10, r. Lhomond, Paris.
8BM Dupont, La Briquette, par Valenciennes.
8BN Berché, 7, place Pereire Paris, Poste à Garches (S.-et-O.).
ches (S.-et-O.)
8BP Veuclin, rue du Cauche, Rugles (Eure).
8BQ Gavaudan, 22, boul. de la Liberté, Marseille.
8BR Jardin, 2, traverse des Sœurs-Grises de Saint-Barnabe, Marseille.
8BS Delaunay, 1, rue d'Astorg, Paris.
8BT Rédier, 9, rue du Cherche-Midi, Paris.
8BU Capitaine Blandel, 18, avenue Victor-Emmanuel, Paris.
8BV Perroux, 96, boulevard Montparnasse, Paris.
8BX Vatinet, 5, avenue Cambetta, Vitry-sur-Seine.
8BY Seksik, 4, rue Reynard, Marseille.
8BZ Milou, rue du Pecher, Montélimar.
8CA Audureau, 29, rue de Bretagne, Laval.
8CB Dussaugey, 29, place du Marché, St-Honoré.
8CC Suquet, 18, avenue Kléber, Paris.
8CD Dussert, Château de Pel.epoix, par Beaumont-sur-Sèze, près Toulouse (Haute-Garonne).
8Cé Motte M., 10, rue du Bloc, Amiens.
8CF Guinand, Bramafan, par Sainte-Foy-les-Lyon.
8CG Dufour, 9, rue François-Bonvin, Paris.
8CH Butez, 77, rue Claude-Bernard, Paris. Poste à Vaucresson (S.-et-O.).
8CI Hubert et Thirriot, 6, boulevard des Deux-Villes, à Charleville.
8CJ Barba, 18 *bis*, rue Demours, Paris.
8CK Dr. Roussin, 25, rue Roserie, Montélimar.
8CL Mme. Lebaudy, Moisson, par La Roche-Guyon (S.-et-O.).
8CM Poizat, à Cours (Rhône).
8CN Lafond, 70, rue des Carmes, Rouen.
8CO J. Gablot, à Dierre (I.-et-L.).
8CP Daudois, à la Queue-en-Brie (S.-et-O.).
8CQ Gouy, 93, rue Armand-Carrel, Sotteville-les-Rouen (Seine-Inférieure).
8CR André Le Blanc, 87, rue St-Jacques, Marseille.
8CS Burlet, 4, rue Tarbé, Reims.
8CT Auschitzky, villa Cyclamen, Arcachon.
8CU Houry, 20, rue des Anguignis, Orléans.
8CV Maurice Lespagnol, 69, avenue du Chemin-de-Fer, Le Raincy (S.-et-O.).
8CX Waddington, Vert-en-Drouais (E.-et-L.).
8CY Burlet, 22 rue de Silliery, Reims.
8CZ Crepin Raverot, allée des Grandes-Ferimes, à Vaucresson.
8DA Saumont, 37, rue Gondard, Marseille.
8DB Colin, 12, rue Dumont-d'Urville, Alger.
8DC Galy, 143, avenue de Saxe, Rouen. Poste à Lyon, Faculté des Sciences (Rhône).
8DD Gaillard, Radio-Club Dauphinois, Ecole Vaucanson, Grenoble.
8Dé Le Blanc, 87, rue Reynard, Marseille.
8DF Ballandreau, 68, boulevard Pasteur, Paris.
8DG Gille, 108, rue Bicoquet, Caen.
8DH Waché de Roo, villa La Baume, route de Morgion, Marseille.
8DI Martin, 63-65, boulevard de la République Nimes.
8DJ Etablissements Radio-LL, 66, rue de l'Université.
8DK Ecole Centrale des Arts et Manufactures, 1, rue Montgolfier, Paris.
8DL Leblond, 65, quai Berigny, Fecamp.
8DM Dr. Baudoin, 120 av. de Flandre, Charleville.
8DN Cheney et Martin, 44, rue de Sèze, à Lyon.
8DO Bourgeois, 5 rue des Futaies, Epernay.
8DP Hueber, 40, boulevard du Roi, Versailles.
8DQ Schlumberger, 2, rue des Francs, Guebwiller.
8DR Société d'Entreprises Electrotechniques, 35, rue du Général-Foy, Paris.
8DS Henri Lemoine, Président du Radio-Club Châlonnais, 35, r. de Marne, Châlons-sur-Marne (Marne).
8DT Caville, 22, rue de la Providence, Toulouse.
8DU Galopin, 28, rue du Pontifroy, Metz.
8DV Barthelet, Port Saint-Louis-du-Rhône.
8DX Amaury, 27, rue de Paradis, Paris. Poste 107, boulevard Voltaire.
8DY Restout, 8, rue de la Haie, Boisguillaume (Seine-Inf.).

**Old Man Ohm Says:**
***"Here is the Ideal Rheostat for all Tubes"***



*Exact size cut of the Marshall-stat*

**$1.75**

—and he ought to know. He is the fellow who measures resistance. He finds that the Marshall-stat varies resistance not step by step, but smoothly, continuously and uninterruptedly from zero to maximum.

He also finds—and you will too—that the Marshall-stat:

Is compact (see exact size cut at left).

Requires only one hole in panel.

Is vernier all the way but requires only one adjustment.

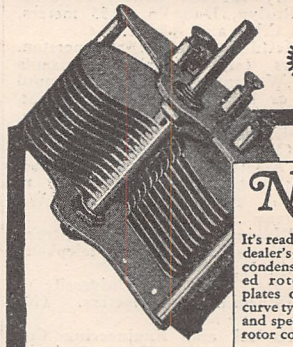
Can be used with any tube or combination of tubes.

Has only two terminals and cannot be connected incorrectly.

MARSHALL ELECTRIC COMPANY
3235 Locust Bl.
St. Louis, Mo.

**Marshall-stat**

***Old Man Ohm has an interesting folder on the Marshall-stat. Send for it.***



**NOW!**

It's ready for you at your dealer's—the STRAITLINE condenser, with grounded rotor, swedged-in plates of logarithmic curve type, cone bearings and special wipe-contact rotor connections.

***Straight line means*** STRAITLINE

More and more circuit specifications are calling for "STRAIGHT-LINE" condensers, because they make calibration easier. But be sure when you buy that you get the original, genuine STRAITLINE condenser. None is genuine without this STRAITLINE label and trademark.

After thorough tests, the Radio News laboratories report: — "The . . . 'STRAITLINE' condenser . . . is undoubtedly one of the most efficient variable condensers that we have tested. The dielectric losses are so low that we could not measure them . . . ."

Type 3 Star 13 Pl. .0003 mfd. $4.00 — Type 4 Star 23 Pl. .0005 mfd. $4.50 — Type 5 Star 43 Pl. .001 mfd. $5.50

Manufacturers, Selling Organizations and Jobbers— *Write for our range of discounts and further information.*

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**HAIG & HAIG MFG. CO., INC.**
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**SUPER-HETERODYNE**
**Ultradyne—Haynes Griffin—Remler**
**Dealers: Send for Discounts**
**HUDSON-ROSS**
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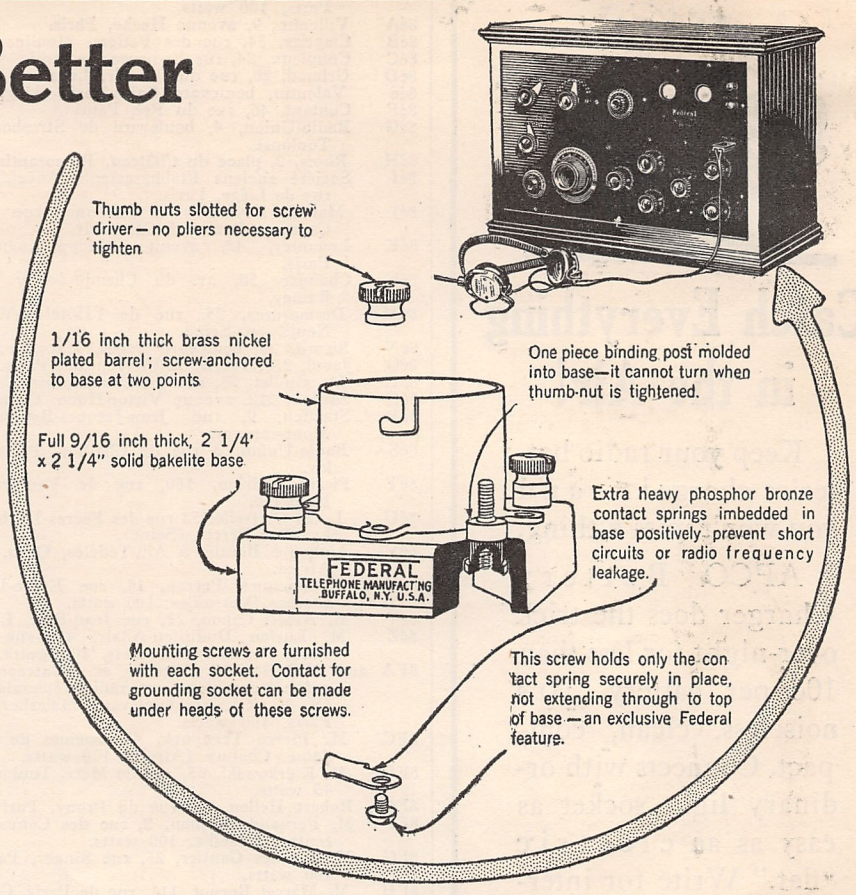
# Why it is Better

THE picture tells the story — seven practical, sensible reasons why Federal sockets should be in your "pet" hook-up.

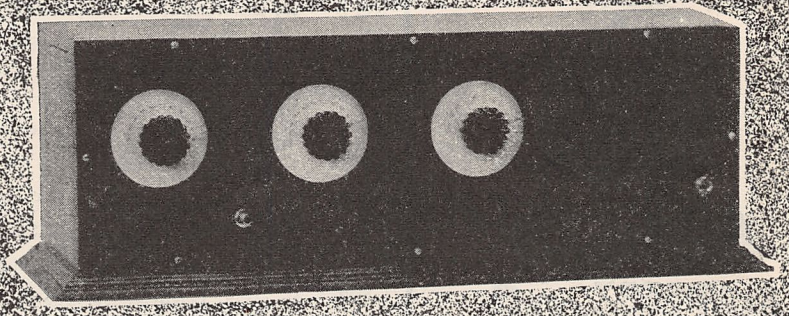
Federal sockets are but another evidence of the care and engineering skill used in designing and making Federal Standard Radio Parts. There are over 130 standard parts bearing the Federal iron-clad performance guarantee — their use means — "Balanced Circuits" with better performance.

FEDERAL TELEPHONE & TELEGRAPH CO.

Boston New York Philadelphia Pittsburgh
Chicago San Francisco Bridgeburg, Canada




Federal
Standard RADIO Products



## What Others Say

"We have received stations from Springfield, Mass., to Honolulu, and from Edmonton, Alberta, to San Juan, Porto Rico (almost 4,000 miles), with good volume on the loudspeaker. On comparison with the superheterodyne, the four tube Biltmore gave the same results. The reflex was easier to handle, however.

ELLISON RADIO SERVICE,
315 13th Ave. East,
Calgary, Alberta, Canada.

* * * * *

"I receive stations all along the coast on the loudspeaker without any antenna. Tone is perfect!

W. A. HOOKER,
Medford, Oregon.

* * * * *

"We receive as far west as Dallas, Texas, without any antenna, and to Havana, with a light socket plug. All on the loudspeaker, and while three strong local stations are going.

THE R. F. MILLER CO.,
113 Frederick St., Mt. Oliver, Penn.

* * * * *

*Write for literature. If your dealer is not supplied, send us his name.*

## Biltmore Master Reflex

4 tube $100
5 tube $125

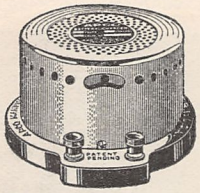
Biltmore Radio Co. Boston 30, Mass.
Dept. N

# Catch Everything in the Air!

Keep your radio batteries charged — and you won't miss a thing.

APCO Battery Charger does the trick over-night for less than 10c per battery. It's noiseless, clean, compact. Connects with ordinary light socket as easy as an electric "flat." Write for interesting circular and nearest dealer's name.

**Apco Mfg. Co.,**
**Chapman St., Providence, R. I.**



**APCO BATTERY CHARGERS**
**for "A" and "B" Batteries**



**fits any Grid Leak mounting**

**FRESHMAN PLUNGER TYPE VARIABLE GRID LEAK** was designed especially for the non-technical set owner who can replace in an instant the fixed grid leak with this new, efficient cartridge type Variable Grid Leak: without requiring the change of a single wire.

*At your dealer or by mail postpaid. Write for free catalogue.*

**65c**
106-7th Ave. New York

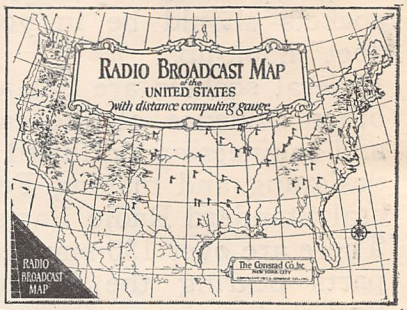

8DZ Hervé, Radio-Union, 3, rue de Chaillot, Paris, 100 watts.
8éA Villemin, 9, avenue Hoche, Paris.
8éB Clayeux, 54, rue des Potiers, Moulins.
8éC Coupleux, 24, rue Esquermoise, Lille.
8éD Grimod, 20, rue du Bel-Air, Laval.
8éé Valentin, boulevard Saint-Roch, Avignon.
8éF Contant, 46, rue du Pré, Pantin.
8éG Radio-Union, 4, boulevard de Strasbourg, Toulouse.
8éH Roses, 2, place du Château, Romorantin.
8éI Société anciens Etablissements Ancel, 36, rue de Liège, Paris.
8éJ Marcel Royer, vil'a Suzanne, rue des Canagues-Bompard, Marseille.
8éK Lemouzy, 42, avenue Philippe-Auguste, Paris.
8éL Chaudre, 50, av. du Chemin-de-Fer, Le Raincy.
8éM Desmasures, 25, rue de l'Hôtel-de-Ville, Neuilly-sur-Seine.
8éN Sicard, 26, boulevard Pagès, Marseil'e.
8éO Jaoul, 230, rue de la Convention, Paris.
8éP Dr. Guillet, 28, rue des Carmélintes, Caen.
8éQ Santou, 212, avenue Victor-Hugo, Clamart.
8éR Staeffen, 9, rue Jean-Jacques-Rousseau, Montmorency.
8éS Radio-Union, 3 rue de Chaillot, Paris, 1 kw.
8éT Pierre Thirion, 160, rue de Vaugirard, Paris-15e.
8éU Louis Cottrelle, 53 rue des Frères-Herbert, Levallois-Perret (Seine).
8éV Alphonse Boutié, à Aïn-Tédélès, Oran, N. Africa.
8éX M. Jacques Perray, 16, rue Emile-Deschamps, Versailles, 100 watts.
8éY M. Albert Capon, 22, rue Jean-Bart, Lille.
8éZ M. Lucien Duditlieu-Allais, 42, rue du Parc, Fontenay-sous-Bois, 100 watts.
8FA and 8FB Société d'Etudes et d'Entreprises radiotélégraphiques et radiotéléphoniques (S. E. R.), 91, boulevard Malesherbes, Paris, 100 watts.
8FC M. Pierre Ternynck, 45, avenue de Sedaine, Chauny (Aisne), 100 watts.
8FD M. Kierkowski, 25, rue de Metz, Toulouse, 45 watts.
8Fé Robert Helleu, 51, rue de Prony, Paris.
8FF M. Fernand Berjoan, 2, rue des Convalescents, Marseille, 100 watts.
8FG M. Jacques Gautier, 25, rue Singer, Paris, 100 watts.
8FH M. Marcel Bornot, 111, rue de Paris, Compiègne, 100 watts.
8FI M. Georges Acher, 12, rue Gérando, Paris, 100 watts.
8FJ M. Paul Levy, Le Blancat, Grand (Basses-Pyrénées), 100 watts.
8FK M. Georges Logerot, 21, rue Morand, Paris, 100 watts.
8FL M. André Blanchard, chez M. Fabre, marchand de bois, route du Cap-Brun, à Toulon, 100 watts.
8FM M. Ferdinand Merckel, 9, rue Félix-Faure, Neuilly-Plaisance, 50 watts.
8FN M. Beauvais, 1, rue Léopold-Robert, Paris-14e, 50 watts.
8FP Paul Moles, 36, rue Léon-Say, à Bordeaux-Talence, 100 watts.
8FQ M. Paul Germain, caporal au 8e génie, Poste radiogoniométrique de Meudon (S.-et-O.), 10 watts.
8FR M. Robert Dubs, 16, rue Richenstein, Mulhouse, 100 watts.
8FT M. Giles de la Tocnaye, 18, rue Choron, Paris, 100 watts.
8FU M. Georges Dardel, 2, rue Lafayette, Mulhouse, 100 watts.
8FX Georges Lévy, 148, faubourg Saint-Martin, Paris.
8FY M. C. Boulet, 101, rue de Rennes, Paris. 100 watts.
8FZ M. Jean Lefebvre, 33, rue des Blancs-Mouchons, Douai.
8GA S. F. R. Poste de Clichy, 15 kw., 85 meters; works from 7 P. M. to 2 A. M. E.S.T.
8GB S. F. R. Poste de Sainte-Assise, 15 kw., 85 and 205 meters; works from 7 P. M. to 2 A. M. E..S..T.
8GC Etablissements Radio-LL, 137, rue de Javel, Paris, 6 kw.
8GD M. G. Duvivier, 1, allée Victor-Hugo, Le Raincy (S.-et-O.), 100 watts.
8GL M. J. Lefebvre, 20, avenue Didier, à Gagny (S.-et-O.).

## When Your Set Stops Working

(*Continued from page* 1410)

the cord. Remove the cord tips from the binding posts on the receiving set and touch them lightly to the binding posts on a dry cell. If a sharp click results, the phones are in working order. If not, fasten the two tips to the binding posts on the dry cell and twist the cord vigorously between the hands, pushing it together and pulling it apart at various points along its entire


# Here's a PERMANENT Broadcast Station MAP




**COMPLETE MAP MOUNTED ON HEAVY CLOTH WITH SPECIAL DISTANCE FINDER ATTACHED**

The Consrad Radio Map is different from all other maps in that it is printed on CLOTH and with proper care will last a lifetime.

The Map measures 17x22" and contains a special distance computing gauge of our own design which enables one to determine the distance in miles between any broadcast station and his receiving set at a glance.

Another special feature of this map is a novel Finder device for locating a broadcast station in quick time.

A complete list of broadcast stations are given on a separate sheet which can be fastened to the map by ordinary paper fasteners.

The map furnished in two colors with the sheet of broadcast stations, enclosed in a two-color heavy manilla envelope 9½x12 inches.

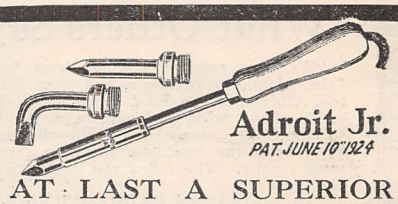
**Price 50c**

***Sold by All Radio and News Dealers***

*If your dealer cannot supply you write direct.*

Published by
**The Consrad Company**
233 Fulton Street New York, N. Y.






AT LAST A SUPERIOR ELECTRIC SOLDERING IRON

# Adroit Jr.

*Works on A.C. or D.C. Cannot overheat*
GUARANTEED FOR ONE YEAR
The most efficient Soldering Iron made

**$2.25** with standard tip: with interchangeable pencil or elbow tip, $2.50. With complete set tips, $3.25.

Nickel plated—Lava and nichrome element. Insulated with mica and special porcelain cement.

*If your dealer cannot supply you send remittance direct to*

**Adroit Tool Co., Inc.,** 14 Front Street New York City

length. If still no click results, disconnect the phones from the dry cell and remove the caps on the phones. Look inside to see if one of the tips has become loose, as illustrated at A in Fig. 2. If it has, connect it to its binding post B. If, however, none of the tips have been pulled loose, make sure that, in each phone, the wire connecting the magnets to the binding posts, as indicated at C, is intact. If one is broken, it must be resoldered and it is advisable to return the phones to the manufacturer to have this done; attempting to do it yourself might result in trouble. If you do not find any of the trouble at points mentioned and the phones still refuse to work, return them to the manufacturer. If they were purchased from a standard manufacturer, they will probably be repaired free of charge or for a very small fee.

### THE VARIOCOUPLER

If, however, your phones test perfectly, and there is no trouble with the crystal detector, the next step will be to investigate the inside of the set. Open the cabinet, or

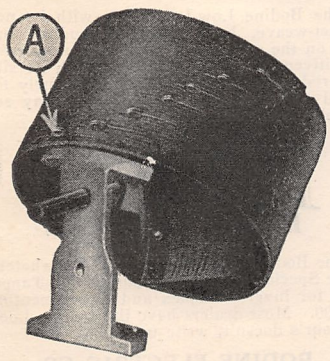



Fig. 3. The variocoupler may cause difficulties through the breakage of a connection.

turn the set around so as to have a good view of the apparatus in back of the panel. Before you do anything else, carefully examine each and every connecting wire. Take each one between the fingers and pull carefully to see that it is firmly secured at both ends. If you find a loose end fasten it. Then connect the set again and it will probably work. If, however, you find no loose or broken wires, turn your attention next to the variocoupler or tuning coil. Make sure that the wire wound upon it has not broken at some spot. If a variocoupler is used, make sure that none of the wires connecting the turns of the stationary coil with the tips are broken. These tips are indicated at A in Fig. 3. If any are found to be broken, repair them at once. If not, examine the pigtails or flexible wires which connect the rotor or movable coil with the binding posts. One of the two may be broken and if so, a new one must be installed. If the rotor does not have flexible leads, but depends upon bearings as connections between the movable coil and the remainder of the set, tighten up these bearings so that they make good contact.

### THE VARIABLE CONDENSER

Failing to find anything wrong with the variocoupler, we must turn our attention to the variable condenser. If this is of the type using a friction contact between a thin strip of metal and the shaft supporting the rotor plates, it may be found that the connection is poor. This point is illustrated by A in Fig. 4A. The procedure here is to remove the contact strip, bend it slightly and replace it so that the end makes firm and positive contact with the shaft. If, however, the variable condenser is of the type illustrated in Fig. 4B, the pigtail or flexible wire indicated by A may have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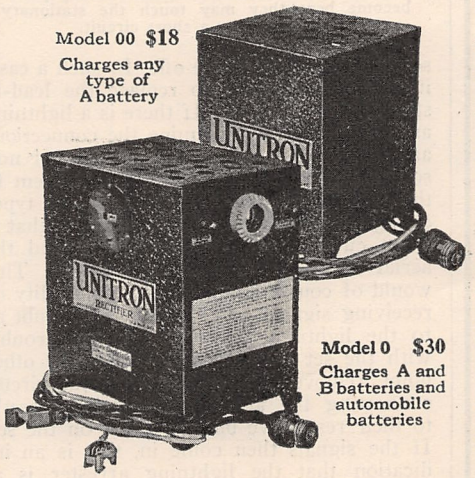


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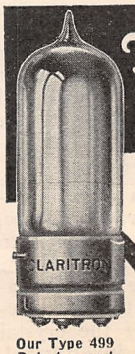


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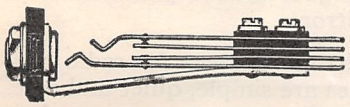

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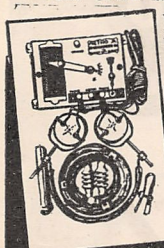

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broken. If so, it will be necessary to replace it.

It may so happen that the rotor plates of the variable condenser have been struck and bent. If so, they are very likely to be touching the stationary plates and thereby forming a short circuit. Refer to A in Fig. 5. If this condition is found to be so, you will have to bend the rotor plates slightly, until none of them touch any of the stationary plates. If any of them are badly bent, it may be impossible to prevent them from touching. In this case it will be necessary to purchase and install a new variable condenser.

### THE AERIAL AND GROUND

If the trouble still persists, there may be a break in your aerial or in the wire connecting the set to the aerial. Examine it carefully throughout its length, making especially sure that it is not broken, where it passes through the wall of the house. If you are using one of the flexible lead-in strips recommended in past articles, it may possibly happen that in closing the window on the strip, the piece of copper was bent

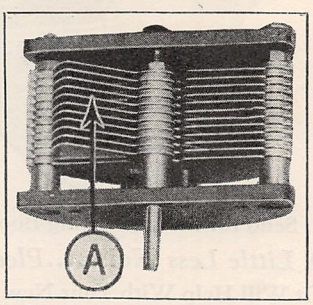



Fig. 5. If the variable condenser rotary plates become bent they may touch the stationary ones, causing a short circuit.

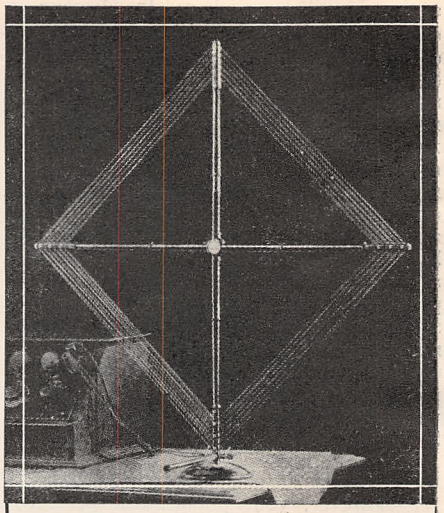
so sharply that it broke off. In such a case, it will be necessary to replace the lead-in strip with a new one. If there is a lightning arrester or switch, examine the connections and make sure that they are solid. If not, scrape the wires clean and fasten them to their respective places. With some types of lightning arresters it is possible that a short circuit may have developed and the aerial thus connected to the ground. This would of course eliminate any possibility of receiving signals. If there is any doubt as to the lightning arrester, and the trouble with the set cannot be found at any other point, remove the arrester from the circuit connecting the aerial and ground directly to their respective binding posts on the set. If the signals then come in, this is an indication that the lightning arrester is at fault. Replace it with a new one.

The next and last point to investigate in connection with a crystal set is the ground. Make sure that the wire from the ground binding post of the set to the ground connection or clamp is not broken at any point. Then investigate the clamp itself. It may be broken or so badly corroded that it does not make good connection with the pipe. If such is found to be the case, scrape the pipe clean and install a new clamp.

It is obvious that if you conduct your search in a systematic manner and cover each and every one of the points mentioned above, that you will locate the trouble quickly and easily.

### A VACUUM TUBE RECEIVER

When one has trouble with a radio receiving set incorporating a vacuum tube, there are many other points to look into aside from those mentioned above. Every point that was discussed in the above paragraphs relating to a crystal detector receiving set, with the exception of the crystal detector itself, will have to be investigated. Then too, there are other points that will have to be looked into in order to locate

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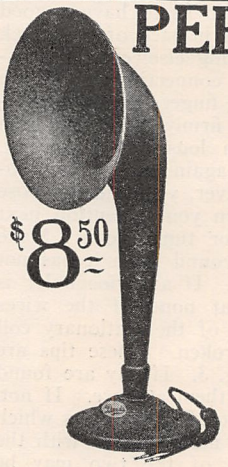

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trouble. These are described below and their troubles listed.

Let us first assume that the set has not been in use for a day or so and that when you go to use it, it refuses to work. The first thing to do is to see whether or not the tube lights. If it does, the trouble is somewhere else, but if it does not, this point must be rectified before proceeding further. It is quite possible that since the time the set was last in use, someone has been investigating the inside of it and may have bent the contact arm of the rheostat so that it does not touch the wire sector. This contact arm is illustrated at B in Fig 6. If you find this to be so, bend the strip down so that the end makes firm contact with the

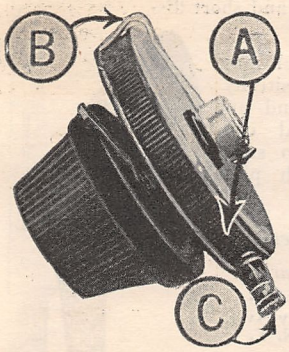



Fig. 6. If the contact arm of the rheostat becomes bent, it may not make contact with the resistance element.

wire. The tube should then light. If it does not, it is possible that one of the convolutions of wire wound on the sector indicated by A in Fig. 6 has broken. This can be determined by sight and if it is found to be the trouble, a new rheostat must be substituted for the one in use. If the wire is all intact, look to the connection to the binding post as indicated at C in Fig. 6. This may have worked loose and if it has, tighten it carefully.

If you have one of the carbon compression types of rheostats, illustrated in Fig. 7, there are one or two points to look for trouble here. The porcelain container indicated by A may have cracked and allowed moisture to get in the carbon content, in which case the disk or the grains may be sticking and the rheostat may not be making good contact. If the rheostat is of the carbon grain type, a small quantity of the grains may have worked out through the crack and spoiled the action of the rheostat. If a crack is found, a new rheostat must be substituted. With this type of rheostat

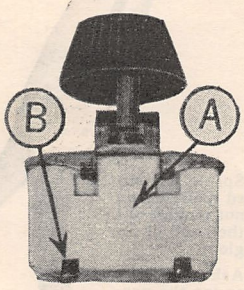
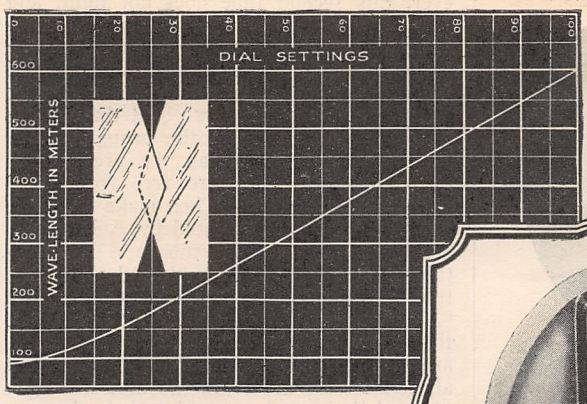



Fig. 7. The resistance pile type rheostat has difficulties all its own which must be watched.

also make sure that the binding posts indicated by B in Fig. 7 are tight.

In some vacuum tube sets, a device similar in appearance to a rheostat and known as a potentiometer is employed. Such an instrument is illustrated in Fig. 8. Note that it has three binding posts. Be sure that each one of them is tight. Then make sure that the wire wound on the sector indicated by B in Fig. 8 is not broken and that contact arm A touches the wire firmly.

Now let us suppose the rheostat to be in good condition and still the tube does not light. If you have another good tube at hand, put it in the socket in place of the one in use. If it lights, it is safe to assume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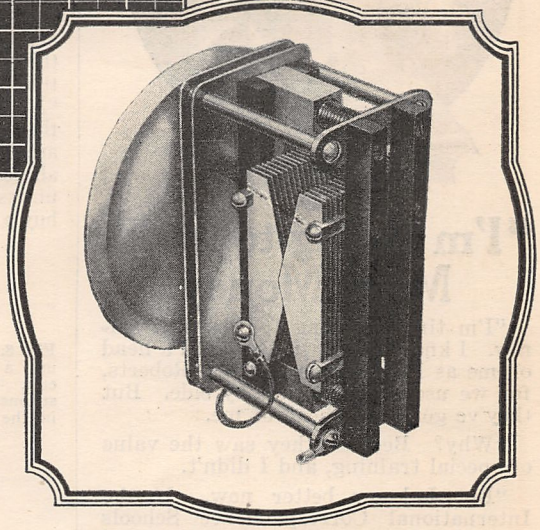

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that the first tube is burned out. If, however, this second tube does not light, and you are sure that your "A" battery is good, there must be something wrong with the socket. Remove the tube and investigate the contact springs indicated by B in Fig. 9. Possibly one of these is so bent that it does not make contact with the prongs on the base of the tube. Clean the prongs and make sure that they are free from dust, grease and corrosion. Then make sure that the binding posts indicated by A in Fig. 9 are tight. Replace the tube and if everything has been done as explained above, the tube will light. If it does not, test your "A" battery with a voltmeter and make sure that the two wires connecting it to the set are in place. If the battery is in order and all connections are tight, the tube will light unless it is burned out. If such is the case buy a new tube. Do not attempt to have the

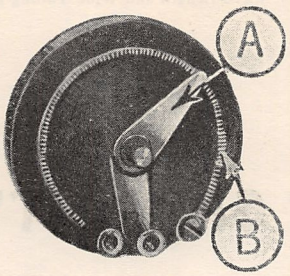


Fig. 8. Some sets use a potentiometer. Such an instrument is shown in the illustration here.

old one repaired, as repaired tubes are seldom, if ever, satisfactory.

### REGENERATION FAULTS

It sometimes happens that it becomes impossible to produce regeneration. This is noted by the fact that turning the dial controlling regeneration does not give any variation in the volume of received signals. When this is found to be the case in a set which always gave satisfaction, the first place to look is the grid leak. A common type is illustrated in Fig. 10A. It may be possible that one of the connections indicated by A is loose. If so, tighten it and try the set again. Then, too, it may be that there is poor contact at the ends of the leak unit as indicated by B. If so, remove the unit, bend the springs toward each other and replace the leak. If the glass tube indicated by C is broken or cracked moisture will have affected the leak resistance and it may have been so changed that regeneration cannot take place. In this case, it will be necessary to use a new unit. If the grid leak is of the variable type, its resistance may have changed so that it will be necessary to vary the leak until it is possible to make the set regenerate. This will usually cause the set to work. A good type of

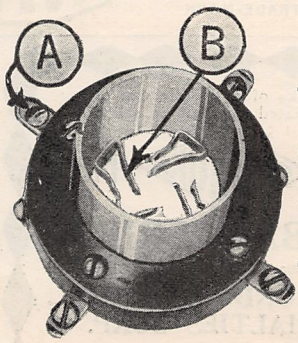


Fig. 9. A bent or dirty prong in the socket which takes the tube may cause signals to fade.

variable grid leak is indicated in Fig. 10B. A rotating arm B, presses a brass strip A, against a carbon resistance unit. The resistance is changed by rotating this arm. If the glass cover, protecting the leak from moisture happens to break, dampness will affect the leak and it will have to be adjusted practically every time the set is used. It is always well to use a variable grid


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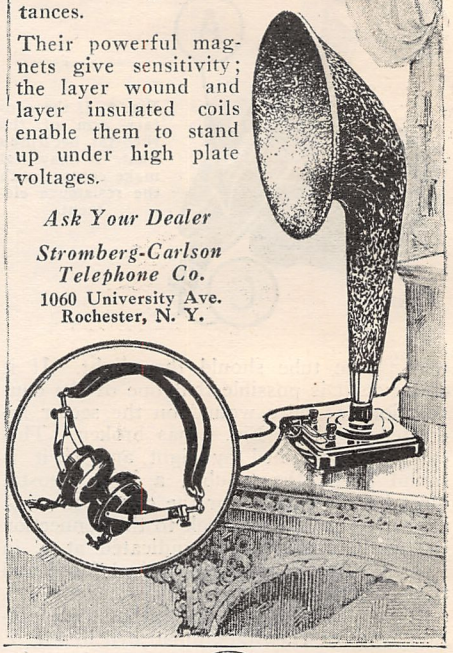



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Another source of trouble in radio receiving sets is the failure of the "B" battery. When a battery gets to 3½ or 4 volts below its rate of voltage, it is safe to assume that it is of little further use. A new one should be substituted. Very often noises in receiving sets that cannot be traced to any other point indicate poor "B" batteries. Test both your "A" and "B" batteries, periodically so as to be sure that they are in working condition.

Most of the tuning instruments used in ordinary single tube receiving sets were described and their troubles discussed in the first part of this article. There are, however, one or two other instruments used in vacuum tube sets that will bear investigation. Very often a variometer is employed. A standard type is illustrated in Fig. 11. This type makes use of pigtails or flexible wires for making connections to the rotor or movable coil. These are indicated by A in Fig. 11. A great source of trouble with variometers is that these pigtails are liable to break. This is partially

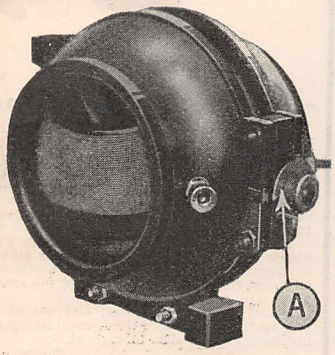


Fig. 11. The variometer also has pigtail connections which sometimes get out of order.

prevented in the type of variometer shown in Fig. 11 by the semi-circular "stop" which prevents the rotor from turning through more than 180 degrees and thereby twisting the pigtail connection unnecessarily. On any variometer using flexible connections to the rotor, make sure that it is equipped with a stop of this nature.

### HONEYCOMB COILS

A honeycomb coil arrangement is illustrated in Fig. 12. All of these types use flexible wires for connecting the movable coils to the other instruments. Here also make sure that the flexible wires are intact and not broken. Breakage of any one of these wires will cause the set to cease operation.

Now that we have discussed in detail every important part of standard crystal and single tube receiving sets, let us mention a few general details. It is a good idea to go over your entire receiving set, antenna and ground as well, periodically, and make sure that everything is shipshape. Every connection must be tight in order to realize the greatest efficiency possible and where binding posts are not used, connections should always be soldered. Make sure that every wire fastened to the bottom of a binding post is clamped securely in position and that the post is tight. Also test the top of every binding post and make sure that it is screwed down on the wire. Such periodic examinations will save much of the trouble often found in receiving sets.

Another good practice is to thoroughly dust out the interior of the set every six months. A soft camel's hair brush may be used for this purpose. All dust should be removed from every portion of the apparatus. Pay particular attention to that settling on the coils and between the plates of variable condensers as well as on the tops of fixed condensers. Remove it all carefully.


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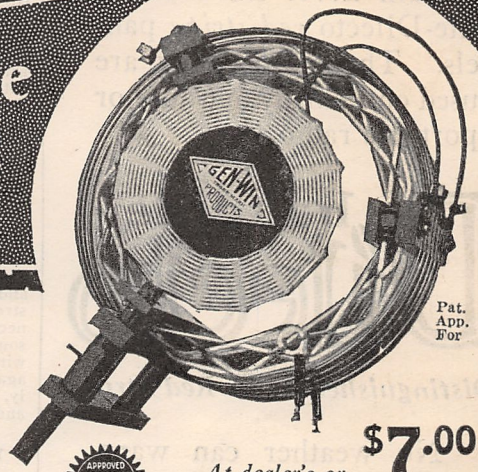


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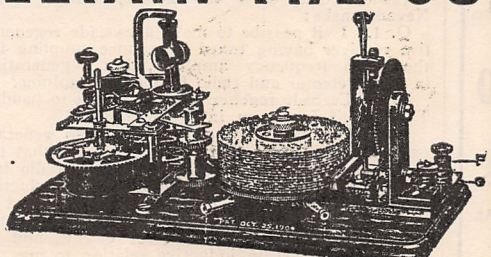

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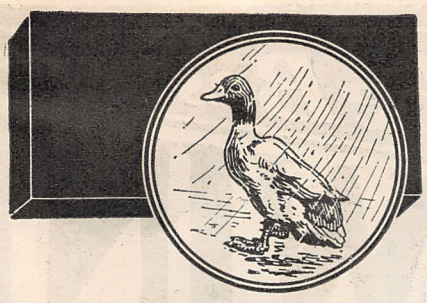

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## I Want to Know

(*Continued from page* 1440)

denser are then varied until the usual click is absent, or heard only faintly. Condenser BC may comprise three large plates, total, arranged as is the usual compensating condenser used to control resistance-coupled radio frequency amplifiers.

From a study of this diagram it will be seen that the bridge principle originally described in the August, 1924, issue of RADIO NEWS, in the article, "The Tropadyne Circuit," by Clyde J. Fitch, has been employed. In the latter circuit, the balance is obtained by means of a variable grid leak placed between the free end of the oscillator coil, and the filament. Since there are no capacities in shunt with the oscillator tuning condenser, in this design, a wider tuning range may be covered.

Q. 3. What is an "electro-dynamic" loud speaker?

A. 3. A loud speaker having a coil of fine wire suspended in a strong electromagnetic field. The fine coil of wire is fastened to the diaphragm and connects to the output of the radio set. The strong electromagnetic field is created by connecting the winding of the electromagnet to a source of direct current. The field of the fine wire coil, produced by a received signal, reacts against the field of the electromagnet very strongly, producing a mechanical motion of the coil, and hence of the diaphragm also.

### RESISTANCE PUSH-PULL AMPLIFIER

(2087) Mr. Loren G. Briggs, McPherson, Kan., asks:

Q. 1. I have been unsuccessful in getting five regenerative receiving sets, each of three-tube type, to function with WD-11 tubes; what would be the reason for perfect operation with UV-201A tubes and yet correct operation with WD-11 tubes for a period of only about six hours, when the signals become inaudible?

A. 1. Your trouble is tube trouble. Your "A" battery must have been too high, or the tubes were defective. The WD-11 has a terminal voltage of only 1.1 volts and if supplied with the full output of a single dry cell, or single storage cell, without a rheostat, the tubes will shortly become inoperative. Often tubes so treated can be reconditioned.

Q. 2. Having found my three-tube, untuned primary, regenerative receiver particularly satisfactory, I would like to add a stage of push-pull audio frequency amplification, using resistance coupling, to the stage of transformer amplification now used; what would be the circuit?

A. 2. The circuit you request will be found in these columns. Condensers A and B will be found helpful for increasing the quality of reproduction from some sets. The correct values must be determined by experiment, but will probably be found to be between .002 mfd. and .006 mfd.

Q. 3. Is it possible to make a Superdyne out of a Radiola V?

A. 3. It could be done, but would require entire re-designing of the apparatus. Even when completed, results would not be as satisfactory as from a set particularly adapted to this circuit. The metal cabinet of your Radiola V would cause undesirable coupling between circuits which should be in non-inductive relation.

### CASCADE REGENERATION

(2088) Mr. Lew M. Meder, Carson City, Nevada, asks:

Q. 1. Is it possibe to make a cascade regenerative receiver having tuned impedance coupling for the radio frequency amplifier, but regeneration in both detector and radio frequency amplifier?

A. 1. Cascade regeneration is difficult to handle. The circuit is shown in these columns.

To reduce the tendency of the set to generate parasitic oscillations, it is quite necessary that the aerial, grid and plate coils of the first radio frequency amplifier tube be placed in non-inductive relation to the balance of the inductances used in the set. The remaining two inductances, viz.: the tuned impedance of the detector circuit, and its relative rotor, are in inductive relation to one another.

To stabilize the control, one stage of audio frequency amplification has been added; this tends to reduce the effects of body capacity which would otherwise be objectionable to a much greater extent, unless special precautions were taken. The use of a grounded-frame condenser is particularly desirable in the positions of C2 and C3. The variable resistor also assists in the stabilization.


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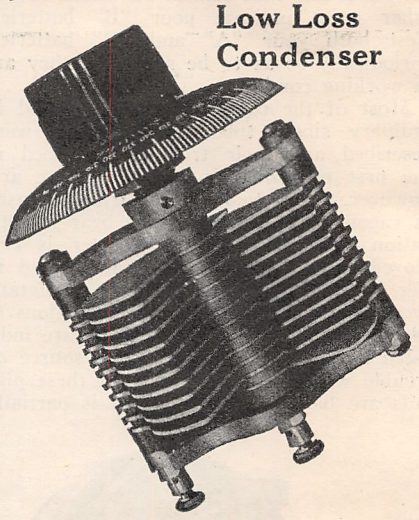

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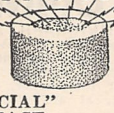

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The value of the "C" battery will be determined by individual conditions. Remember that its uses reduces distortion, increases the "B" battery life and reduces the tendency to oscillate.

Q. 2. I have been advised that placing the "B" batteries on a dry wood board on a radiator is not desirable, as it makes a capacity to ground and sometimes causes considerable feed-back to the input side of the set. Is this correct?

A. 2. In addition to the above, and primarily, it will greatly reduce the life of the "B" battery due to the great acceleration of the action of the acids on the metals. "B" batteries should always be kept in a cool, dry location.

Q. 3. If it is convenient to give storage "B" batteries a booster charge every day, would there be any disadvantage in tapping off different voltages for the radio frequency amplifier, detector and audio frequency amplifier?

A. 3. Since the drain of the high voltage end of the battery would be subnormal and the drain on the low voltage end of the battery would be abnormal, the cells comprising the low voltage end of the battery would expand and contract and generate gases to a much greater degree than those at the opposite end, causing a loss of the active material due to its dropping out of the grids. This would result in much quicker depreciation of these cells.

That is an argument in favor of the expensive but more efficient arrangement of individual batteries for the three voltages you mentioned.

## The Cornadyne Circuit

(*Continued from page* 1387)

Said the Chief Engineer:

"It is the Cornadyne, though Maltadyne or Superhydrodyne will serve as well. It involves, like the Ultradyne, an entirely new principle, in this particular case, for stilling the ether through a process or stage of hydrostatic coalescing or a humidity fumer preceding or placed ahead of the tuner in which the hydroelectrostatic discharges may spend themselves.

"In line with the argument here by our famous Aqueduct Engineer, *Bull Montana*, who advocates the necessity for a great overhead sewer system as being the only answer in making it possible to put all present overhead wires underground, this hook-up, or underground antenna was advocated. The discussion is rather lengthy in which the exact relationship between litres to the stave length is brought out; the proper number of jolts from the A bottles to excite the loud talker from a position below the table. We have experienced a good deal of interference here from stuff coming over the Canadian Line which this hook-up eliminates and some of the users have found that there is nothing like it in keeping the home fires burning. I could go on for hours but after all we know little of radio here in the West; under the ground it has all been developed by "Fleischmann in the Yeast."

## Reflex Receivers in Theory and Practice

(*Continued from page* 1417)

start oscillating, and very often this oscillation may be stopped simply by touching certain parts of the receiver, indicating that a trigger effect is present.

### STOPPING BUZZING

To stop any tendency of the Fig. 19 circuit to buzz, it is desirable to try reversing the leads to the primary of the iron core transformer. If this does not improve matters, a very effective method of quieting a reflex circuit is to connect a resistance of the order of 100,000 ohms across the grid of the tube and a terminal of the filament battery. It has been usual to connect this


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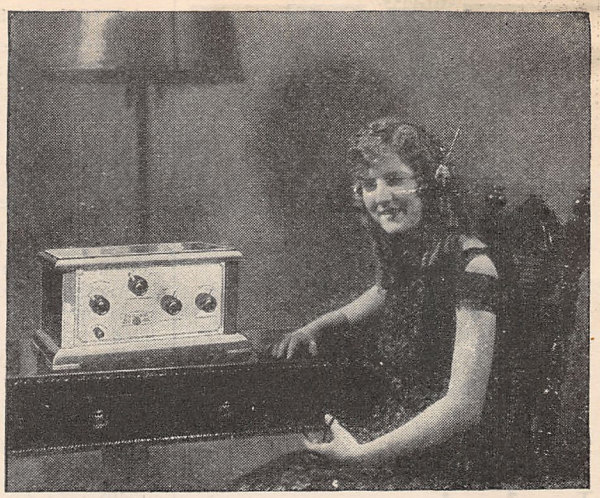

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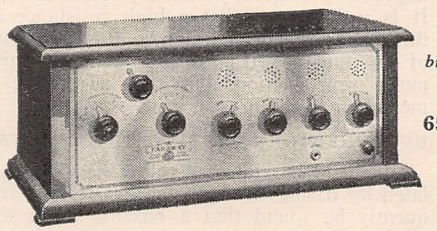

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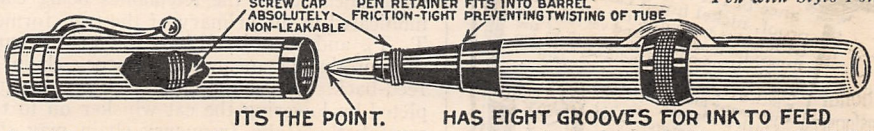


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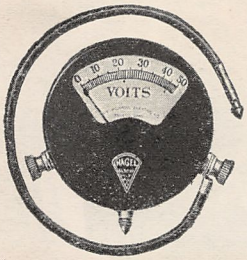


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resistance across the grid of the tube and the positive terminal of the "A" battery.

### ACTION OF STABILIZING RESISTANCE

The action of this stabilizing resistance, which may be a fixed resistance, of 100,000 ohms, or a variable resistance varying from 50,000 to 100,000 ohms, is really threefold. In the first place, it introduces damping into the radio frequency oscillatory circuit, thereby lessening the tendency of the tube to produce radio frequency oscillations, which usually result in the establishment of a special form of audio frequency feed-back, which has been already discussed.

Another important effect of the resistance is to introduce damping into the audio frequency circuit and so lessen the degree of audio frequency feed-back, due particularly to the effect described in connection with Fig. 17 and Fig. 18.

This latter effect may be obtained by connecting the 100,000 ohm resistance across the secondary, $T_2$, of the iron core transformer, $T_1$ $T_2$, of Fig. 19.

Fig. 20 shows the arrangement when the 100,000 ohm resistance is connected across the grid and filament of the tube. There is, of course, no point in using this resistance if it is not found necessary, but usually it will be found highly important to take advantage of the damping effect of the resistance. If a variable 100,000 ohm resistance is used, the damping may be varied, and this will be found very convenient, although a poor variable resistance is very much worse than a fixed one, and experimenters should be on their guard against the resistance, which may have too low a value. Sometimes it has been found that a resistance of about 40,000 ohms has been used, although the value was supposed to be 100,000 ohms. The result, of course, is a very big diminution of signal strength, whereas a 100,000 ohm resistance should make practically no difference in the signal strength.

The third feature of the resistance is to improve the quality of the reproduction. It is well known that a high resistance of this order, connected across the secondary of an intertube transformer, tends to give purer reproduction, but this advantage is incidental in the present case.

### BUZZING WHEN LIFTING THE CRYSTAL

When the crystal of a reflex circuit is isolated by lifting the cat whisker, it will frequently be found that a buzzing noise will be heard. This frequently happens in the S.T.-100 circuit, which will be described later, and which is a two-tube reflex arrangement. Here, there can be no question of the audio frequency feed-back with a radio frequency link taking place, because the crystal detector is now not in use and there can be no rectification. The question is: How do the output audio frequency currents get transferred to the grid circuit to produce audio frequency feed-back? The explanation must be that described in connection with Fig. 17 and Fig. 18, the currents being fed back by virtue of the potentials established across the telephones being communicated to the primary of the transformer, $T_1$ $T_2$, and then back into the grid circuit, thus producing an audio frequency chain of feed-back. When the crystal circuit is completed by lowering the cat whisker on to the crystal, the audio frequency chain may still be present, but the crystal has a very appreciable damping effect on the primary winding, $T_1$, and will frequently be sufficient to stop excessive audio frequency feed-back.

Experimenters will have found, no doubt, that varying the pressure of the cat whisker on the crystal frequently varies the tendency towards audio frequency howling, and the reason is that the resistance of the crystal varies according to the pressure of the cat whisker on it, and this varying resistance alters the damping of the transformer

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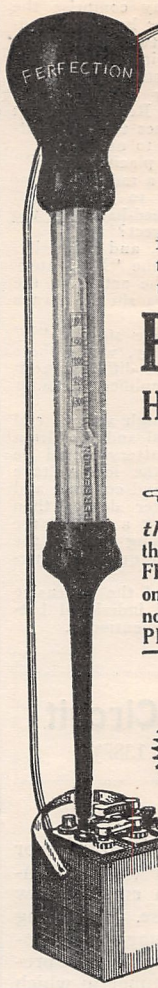


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winding, and so varies the feed-back effect. A big pressure on the crystal, provided the crystal rectifies well, is, of course, best from the point of view of stability.

The trouble due to the potentials across the phones being communicated back to the grid circuit may be overcome in several ways, and the effect is not found when a transformer is used instead of a tuned plate circuit.

Another method of overcoming the trouble is illustrated in Fig. 21, this time the tuned plate circuit being kept separate from the direct plate circuit which contains the telephones. It will be seen that a radio frequency choke $L_4$ is connected in the direct current plate circuit, together with the telephones T and the high-voltage battery $B_2$. A coupling condenser $C_4$, which may have a value of .0003 mfd. to .002 mfd. (its value does not seem to matter), serves to feed the radio frequency impulses into the tuned circuit $L_3$ $C_3$, which is now separate instead of being connected directly in the plate circuit. This separation of the direct and audio frequency currents from the radio frequency currents was explained earlier in this series, and we have here a practical use of the arrangement, a use, moreover, which results in greater stability. The arrangement is, therefore, not merely an alternative, but an alternative with certain advantages, although the arrangement is a little more complicated, and which, in some cases, may not be quite as efficient, from the point of view of signal strength, as the plain tuned plate arrangement. For broadcast wave-lengths the coil $L_4$ may be a 250 turn honeycomb coil, which will be suitable for wave-lengths up to 600 meters. Correspondingly larger choke coils are required for longer wave-lengths.

Fig. 22 is simply the arrangement of Fig. 21, feed-back being now obtained by coupling the inductance $L_3$ to $L_2$.

## Regeneration and the Patent Situation

(*Continued from page* 1424)

desired regenerative action. In Fig. 3 Armstrong showed how regeneration could be secured by tuning the plate circuit to resonance with the grid circuit by an inductance. Fig. 4 of the Armstrong patent showed a receiver in which the telephones were connected in the lead to the filament common to both the input and output circuits so that regeneration might occur through the coupling provided by the telephone receivers and the capacity of the long telephone cords extending from the receiving set to the telephone headset. In Figs. 5 and 6 the input and output circuits are shown as interlinked by inductances. The inductances form the path for regenerative action of the tube circuit, but it will be observed that none of these circuits resemble the popular tickler circuit of the modern broadcast receiver such as illustrated in Fig. 7. The reason,

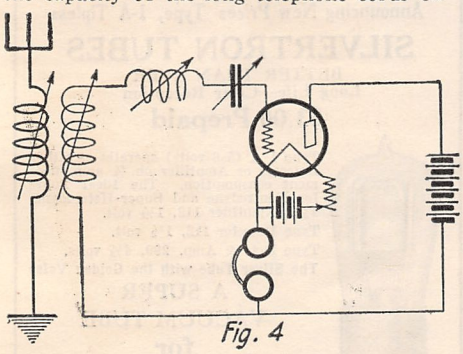

*Fig. 4*

Armstrong regenerative circuit with telephone receivers connected in a path common to both the input and output circuits.


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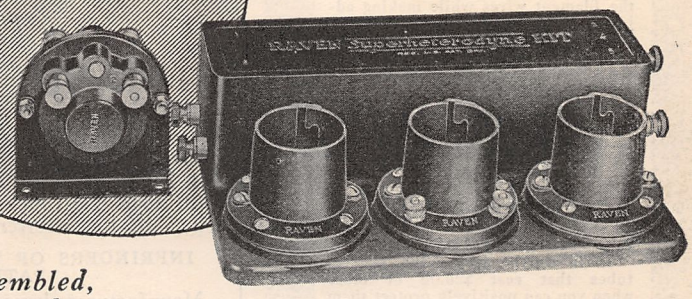

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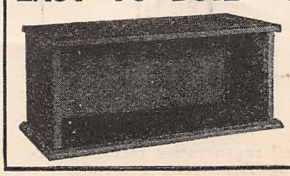

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however, that the Armstrong patent covers the modern tickler radio receiver is that the principle of regeneration is present in the receivers having the circuit of Fig. 7—

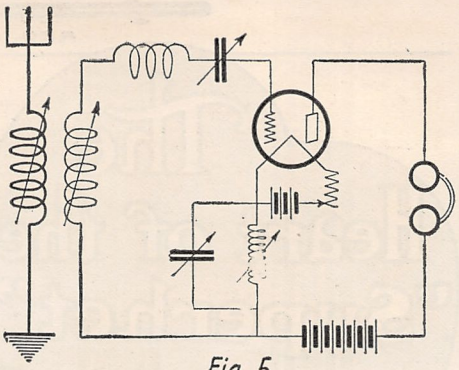

Fig. 5

Armstrong regenerative circuit with tuning inductance common to the input and output circuits.

that is to say, energy is fed back from the output or plate circuit through the tickler coil T into the input or grid circuit by the electromagnetic coupling with the secondary coil S of the receiver.

### INFRINGERS OF THE ARMSTRONG PATENT

Manufacturers have in many instances refused to recognize the Armstrong patent as covering the modern tickler circuit receiver, as represented in Fig. 7, or in an equivalent combination. The Patent Office records list

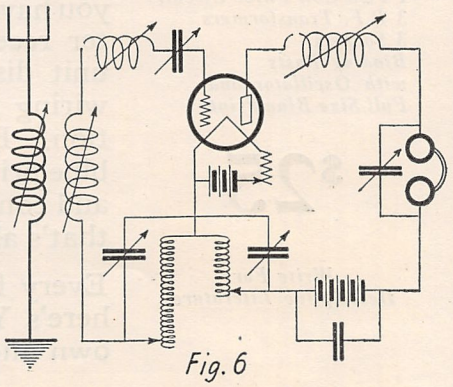

Fig. 6

Armstrong regenerative circuit having inductance tuning both the output circuit and a circuit common to the input and output circuits.

some thirty odd suits which have been brought by the Westinghouse Electric & Mfg. Co. against infringers of the Armstrong patent on simple regenerating circuit receivers. Thus far the adjudication of the patent has not been overthrown and injunctions have been secured against infringers. The art may still see some defendants of sufficient strength to contest the Armstrong patent. The outcome of the claim by Edwin H. Armstrong v. The United States of America by suit pending in the Court of Claims may add another interesting chapter in the litigation under the regenerative circuit patent.

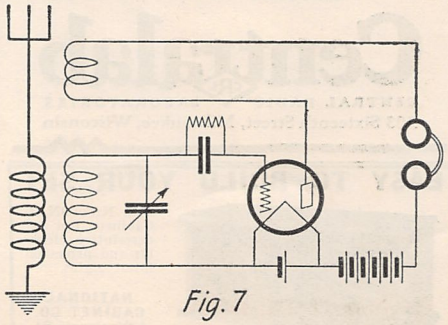

Fig. 7

Modern tickler coil regenerative receiving circuit employing Armstrong principle.


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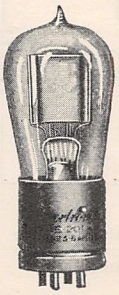

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### C. W. RECEPTION

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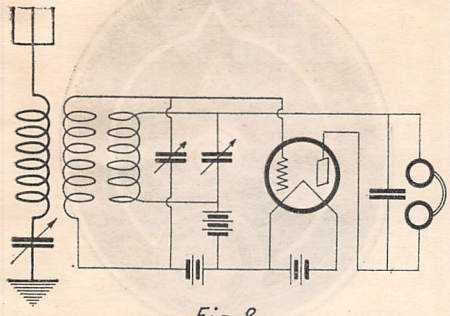

*Fig. 8*

Langmuir three circuit C. W. receiver.

in a condition of oscillation and those in which the tube operates at a point below oscillation. A patent reissued to the General Electric Company covers the circuit shown in Fig. 8 where the input and output circuits of the tube are actually coupled in the form of a three-circuit set. A tickler coil 8 is coupled with primary coil 13 and secondary coil 9, and oscillations are produced by the tube circuit of a different frequency from that of the oscillations to be received, so that the receiver operates as a self-heterodyne. Beats are produced equal to the difference between the local and incoming frequency and the signals thereby observed. For modulated and I.C.W. this

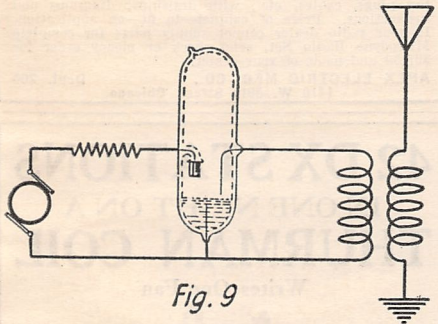

*Fig. 9*

Weintraub mercury vapor tube receiver which avoids Armstrong patent.

same circuit may be employed with the circuits in condition of regeneration for the reception of signals.

### NON-INFRINGING CIRCUITS

The manufacturer may find comfort in the Patent Office records which show just what circuits may be used without patent infringement and what circuits should be avoided. Weintraub in a patent dated June 15, 1909, assigned to the General Electric Co., showed a receiving circuit utilizing a three-electrode mercury vapor tube as a rectifier. This tube actually employed a control similar to the grid of the modern three-electrode tube and the circuit is freely usable without infringement of the regenerative patent.

The expired DeForest amplifier patent containing the diagram of Fig. 10 shows

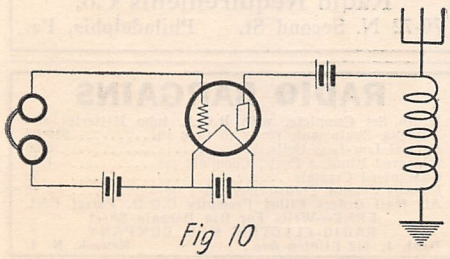

*Fig 10*

The straight DeForest amplifier-detector circuit which does not infringe the Armstrong patent.


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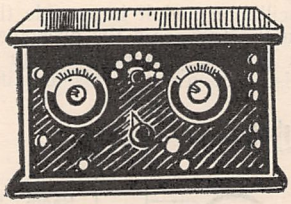

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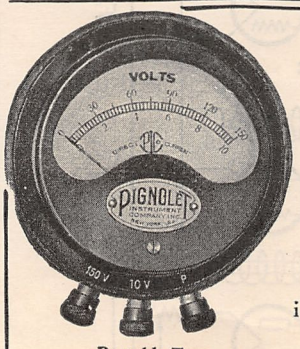


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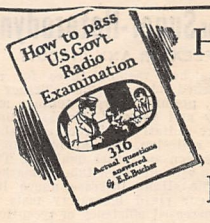


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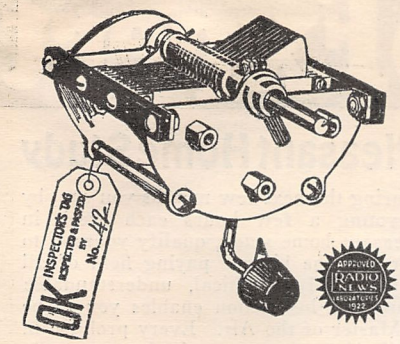


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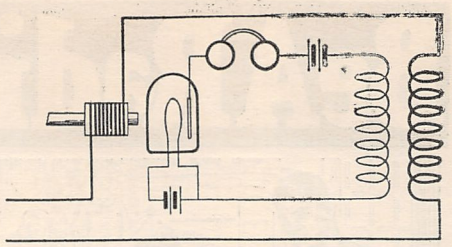

*Fig. 11*

DeForest circuit of 1907 which may possibly have produced oscillations in an electron tube circuit.

an amplifier circuit which can be freely used in connection with a straight electron tube detector or a crystal detector without infringement of the regenerative patent. An interesting point arises in considering the amplifier patent. Fig. 11 shows an arrangement disclosed in this DeForest patent for amplifying feeble electrical energy. The

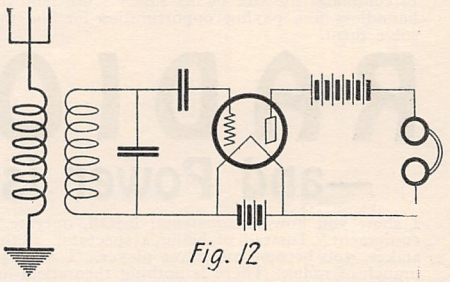

*Fig. 12*

DeForest straight detector circuit which does not infringe upon the Armstrong patent.

control member is a magnet situated adjacent to a two-electrode tube and connected in an input circuit which is coupled with the output circuit of the tube. The circuit is capable of oscillation and it is possible that DeForest actually discovered the phenomena of oscillation in tube circuits, although he tucked the discovery away in his amplifier

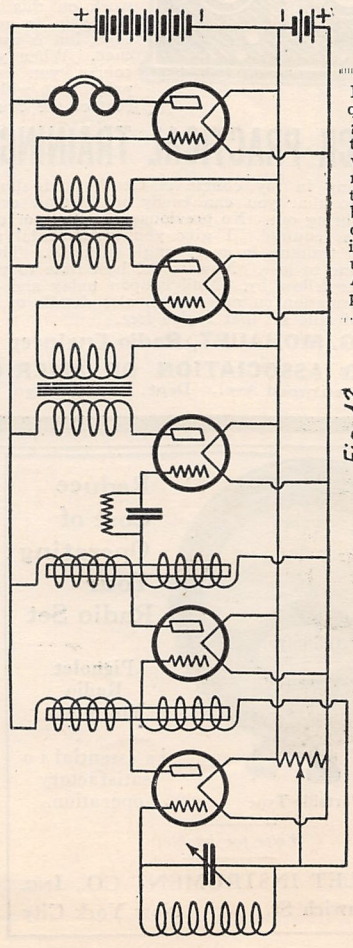

*Fig. 13*

Radio frequency amplification circuit which most authorities believe does not infringe upon the Armstrong patent.


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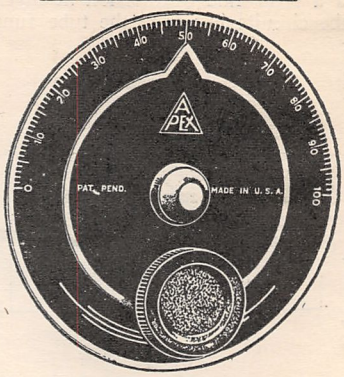


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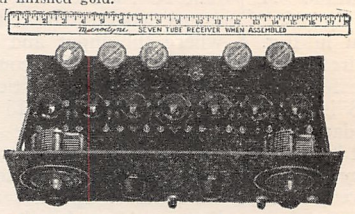

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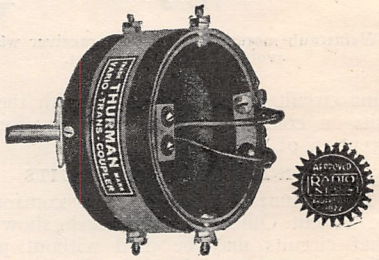


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patent of January 15, 1907. The electron tube detector circuit of DeForest patent 879,532 represented in Fig. 12 will be free for use after February 18, 1925, as that is the date of the expiration of this famous patent which has so long controlled the three electrode tube detector circuits. Of course, there are other patents still to be considered where the manufacturer departs from the particular circuits notably among which are the grid leak circuit patents.

### RADIO FREQUENCY AMPLIFICATION

The most important question confronting manufacturers is: What bearing does the Armstrong patent, which covers regeneration, have upon radio frequency amplification and reflex circuits? We naturally look to the Courts for the answer to this question. In the Westinghouse suit against the DeForest Co. the defendant referred to the prior work of Schloemilch and Von Bronk on radio frequency amplification and reflexing as anticipating the work of Armstrong. The holders of the Armstrong patent very

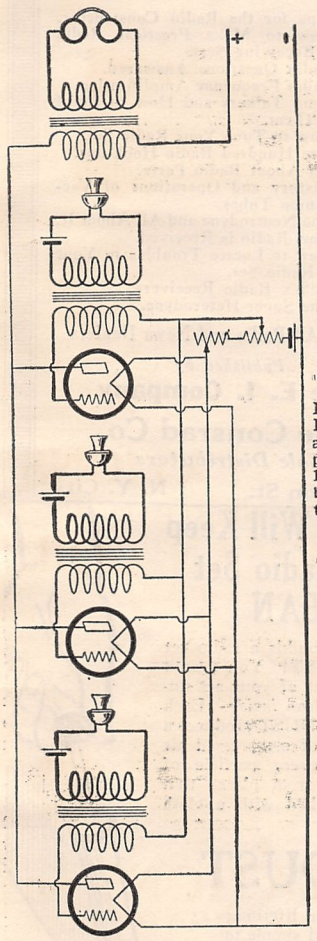
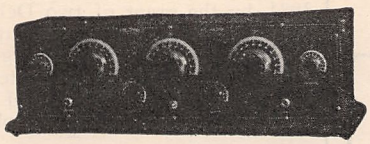


Fig. 14. Von Lieben, Reisz and Strauss amplifier circuit of 1911 having stabilizer control for grid potential.

definitely distinguished at that time these prior circuits had nothing to do with the Armstrong invention. The straight radio frequency amplifier and reflex circuit, therefore, should be fairly well eliminated from the Armstrong claims. A typical radio frequency amplifier circuit which should be free of infringement of the Armstrong patent is represented in Fig. 13. The question which of course arises is, does the stabilizer and grid control which may inherently permit regeneration in the radio frequency amplifier circuits bring this radio frequency amplification circuit under control of the Armstrong claims? The answer to this is found in the early publications of Von Lieben, Reisz and Strauss, who more than two years before the filing of the Armstrong application taught the method of connecting three electrode tubes in an amplifier circuit and controlling the grid potential by a stabilizer, as illustrated in Figs. 14 and 15. It is difficult to see how the Armstrong patent can ever


# HEATH RADIANT

## Non-Dielectric Condensers



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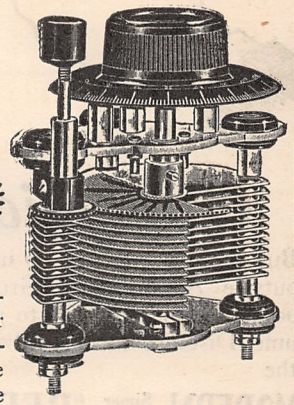

THE A. C. Electrical Co., in designing their *Polydyne Receiver,* looked for the make of condenser which could stand up under all sorts of usage without lessening its efficiency one particle. That their choice was the HEATH RADIANT Condenser bears out the HEATH claim of *permanent efficiency*:

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|---|---|---|---|
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| No. 44AV | 44 Plate | 6.50 | 5.85 |

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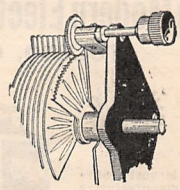
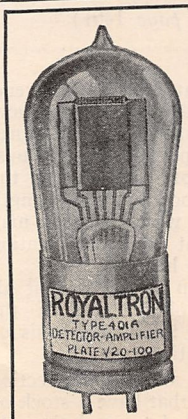
Ordinary adjustments reduced by separate geared adjustment to hairbreadth distinction. We guarantee the Heath Vernier Condenser to be more highly selective than any condenser employing a vernier which actuates ALL of the plates.



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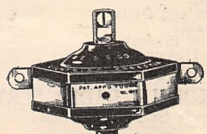

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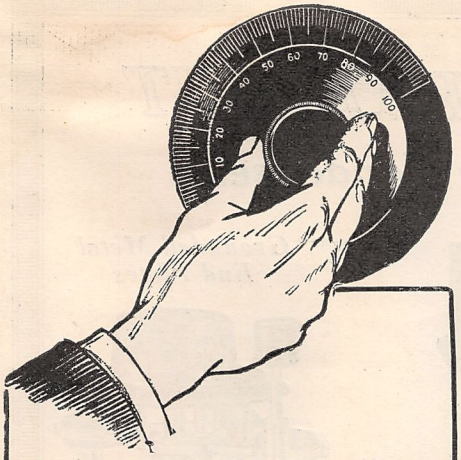

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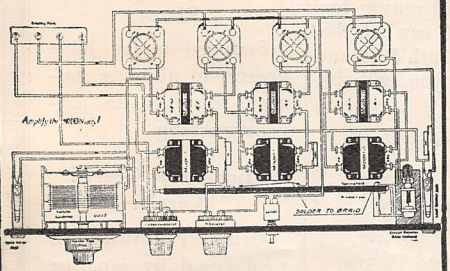

This set is easy to build and your friends will marvel at the results. Full size wiring diagram and complete constructional bulletin of above circuit sent on receipt of 4c in stamps. Write for it today.

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**The Modern Electric Mfg. Co.**

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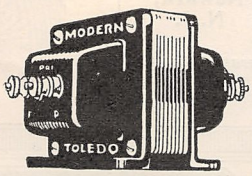


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be construed to cover the stabilizer arrangement of Fig. 13 when more than two years before the filing of the Armstrong application this same circuit was disclosed by others. The two-year period mentioned is the statutory bar period which precludes the granting of a valid claim upon that which has already been published.

### DeFOREST OSCILLATOR PATENTS

The art was surprised on September 2, 1924, by the grant of two DeForest patents covering the tube as an oscillation generator in association with transmitting antennae circuits. Suit was filed on September 3, 1924, the day following the grant of these patents, by the DeForest Radio Telephone & Tele-

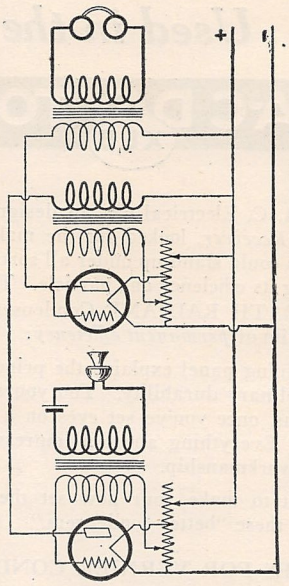


Fig. 15. Amplifier circuit published more than two years prior to the filing of the Armstrong application which is believed to give the manufacturer the right to employ potentiometer control in radio frequency amplification without infringement of the Armstrong patent.

graph Co. against the Westinghouse Electric & Manufacturing Co. probably aimed at the Westinghouse broadcast stations. It is just a situation of this kind which precludes definite opinions permanent in their character on the subject of radio patents. The reason for this is that the Patent Office at Washington is granting approximately fifty patents each month bearing on the subject of radio and the patent situation is thereby shifting like the everchanging tide with each week's issue of radio patents. We can only be sure of the situation after a Court has passed upon the merits of the patents in question. Judge Mayer did this in the case of the Armstrong patent. The Court seemed to wholly appreciate just what the inventor Armstrong had accomplished.

## The New Radio Stamp Fad

(*Continued from page* 1401)

album is divided into states and at the end of each division has a space for several new stations which may be installed in the future.

At the close of the portion for stamps, there is a complete list of stations with the names of their owners, location, wave-length and four subdivisions in which the fan may insert the dial settings at which the station makes its appearance on his set.

Let us hereby offer up a prayer that all our friends forthwith obtain one of the albums and so put radio tales on a basis of fact rather than imagination!

Just send for the album and begin collecting the stamps. All stations that have a stock on hand will be only too glad to send them to those who have proof of reception.

Stamps and albums by courtesy of the Ekko Co.


# I WANT TO KNOW

The E. I. Co. publishes 15 complete, practical 64 page books, covering the care and operation of every part of your Radio sets, also special books on the latest receivers. They cover every important question a radio set user may ask and are written by radio's foremost authorities. Each book is 5½ by 7½ inches, fully illustrated, bound with handsome stiff covers printed in colors.

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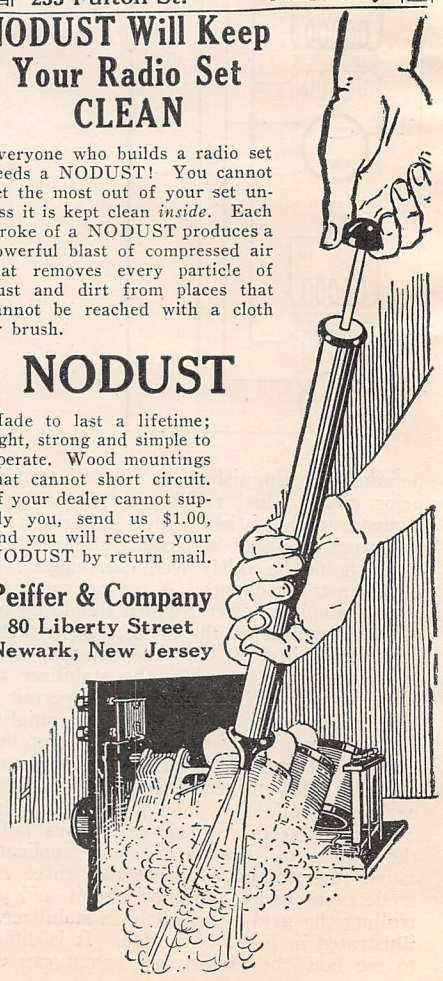

## NODUST

Made to last a lifetime; light, strong and simple to operate. Wood mountings that cannot short circuit. If your dealer cannot supply you, send us $1.00, and you will receive your NODUST by return mail.

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**Newark, New Jersey**

## Experimenting with Five Meters

(*Continued from page* 1423)

measurements for as many settings of the condensers as you desire. The same applies to the wavemeter or resonator described in the last installment. This calibration is very helpful if you wish to go on experimenting with short waves, especially when you will build a receiver for them.

In the next article we will discuss the method of "Keying" this transmitter.

## New Developments of Vacuum Tubes

(*Continued from page* 1384)

and internal capacity and to allow the electronic emission from the filament to have an unobstructed passage to the plate.

The filament is the V-type and the plate construction is practically the same as the ordinary type of vacuum tube. As may be seen in the illustrations the grid, or "control electrode," is a saw-toothed plate placed parallel to the plane of the filament, between which the legs of the filament are placed.

An excellent result of this type of construction is that the internal capacity of the tube is reduced about one third that of the ordinary tube. This feature is especially desirable for tubes that are used in the radio frequency stages of a set, as the great disadvantage of the ordinary tube is the relative high capacity between the grid and plate. These tubes serve well as detectors with about 45 volts on the plate, and are also excellent in the stages of audio frequency amplification.

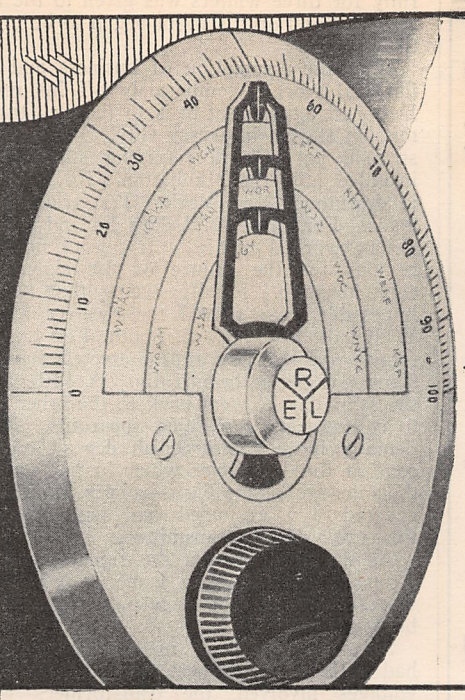
## The Life and Work of Lee DeForest

(*Continued from page* 1403)

"Once let me get the power, be the dictator to decide—and I will dictate. *Then* I may hope to succeed, freed from the shackles and impediments of my fool friends. Never was one so tied down and handicapped. 'Poverty,' George says, 'is no disgrace, but it certainly is damned inconvenient!' I have had to do it all, be diplomat, inventor, executive, errand boy and janitor. And I draw five dollars a week if I am lucky. Three months of this work have shown me the disparity between the inventor's and the investor's points of view."

Finally John Firth, an experienced salesman, had become interested in the company and brought his financial experience to the aid of the others. A plan was drawn up and executed. The following month, the DeForest Wireless Telegraph Company of America was organized and incorporated under the laws of the State of Maine, with an authorized capital stock issue of $3,000,000. The parent company was bought over together with its patent rights and inventions and equipment extant.

"Old Man" Seidler did not like this idea particularly, so when the opportunity offered he sold his share in the company to Barbour. Things immediately began to run more smoothly, the public was beginning to take an interest in this newest of scientific wonders. Stock began to sell and DeForest raised his salary to the enormous sum of thirty dollars per week—his high water mark since leaving college! At last the old tan overcoat which had served so faith-

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Designed by R. E. Lacault, E.E., A.M.I.R.E., inventor of the famous Ultradyne circuit. This monogram seal (R.E.L.) is your assurance of Lacault design.

Stop fishing for your favorite station. *Select* the program you want—get it lightning-quick. Replace your old dials with ULTRA-VERNIER Tuning Controls. Then, when you have tuned in a delightful station, pencil-record it on the dial. Never again need you guess or fumble for that station, or bother with wave-lengths. Simply turn the finder to your pencilmark, and you hear it!
Should you move—or a station discontinue or wave-lengths change—erase the marks, leaving the dial beautifully clean and new. Thus, you may *now* have all the joy of radio, with none of the discouragements. Moreover, the ULTRA-VERNIER is a single vernier tuning control.

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Made by the Hammarlund Mfg. Co., your assurance of quality and dependability—produced solely for the Phenix Radio Corporation.

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High grade, standard radio products that will increase the efficiency of any set and add to the satisfaction of the user. Ambassador Low Loss Products have long been the choice of particular fans. See them—compare them, and you will choose them too.

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Write for FREE diagrams of circuits in which Ambassador products can be used.
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To hear the natural tones of an artist's voice both in music and speaking, no Radio Instrument can compare with a crystal receiver.

With the VAN FIXED CRYSTAL Receiver your station is heard the instant ears and phones meet. First expense only. No batteries or tubes. Distance guaranteed with outside aerial 25 miles. A trial, you'r satisfied, and your friends will want one.
Receiver only $3.50
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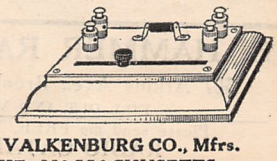
Not made to sell at a price but to give satisfaction.

Remember it has a FIXED CRYSTAL.



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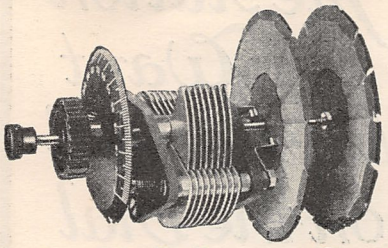
*The Perfect Tuner*

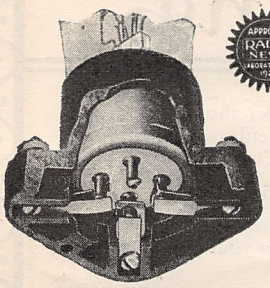


*For Tuned Radio Frequency Circuits*

This kit is made up of three Consomello Tuner Units consisting of Condenser, Coils and Dial. This unit tunes both by capacity and inductance. Each kit includes complete instructions for building a tuned radio frequency set consisting of two stages of radio frequency, detector tube, and one or two stages of audio amplification. Registers from 200 to 600 meters.

***Price Complete*** **$15.00**

## Mazada Socket



**Triple Action**

Study the sectional view and see how this wonderful socket works. Made of guaranteed bakelite; contact springs are bronze nickel plated. Neat and compact.

***Price*** **$1.00**

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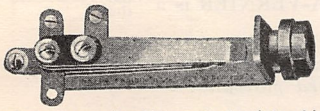

Mazada Jacks have coin silver contact points which will not burn out. Plug guide requires only ⅜" panel hole. Carefully finished and nickel plated.

Five types: Open Circuits, Closed Circuits, Double Circuits, Filament Control Single Circuit, Filament Control Double Circuit.

***Now Ready For You***

The new Consomello Audio Transformer—made in two ratios—3 to 1 and 5 to 1. Highest possible perfection of manufacture. Beautiful oxidized finish. Write for full information.

**If your dealer cannot supply you with Mazada products, write us direct.**

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FILL OUT AND MAIL

Please send me FREE, Your NEW RADIO CATALOG

Name .....

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fully for three winters was given to the rag man and DeForest's room began to be beautified again.

With the assumption of business and the financial worries temporarily off his mind, DeForest again went back to the new transmission station in Jersey City. For demonstration purposes, a receiving station was installed atop the Manhattan Life Building in downtown New York. Test trials were made. For three solid days he and an assistant worked manfully trying to find the reasons for the failure of the signals to come through. Finally, seeing that it was impossible, they moved the receiver to the Whitehall Building at South Ferry. No sooner was this new station erected than the signals came in beautifully. A little later the same day he went back to the other side to collect some remaining apparatus. Accidentally he saw a greenish deposit on the edge of the dome over which he had erected the antenna. Like a flash—copper. The dome covered was grounded and had absorbed the power of the transmitter.

At the new location the signals came in strong. That is, they came in when the transformer or the condensers were not broken down.

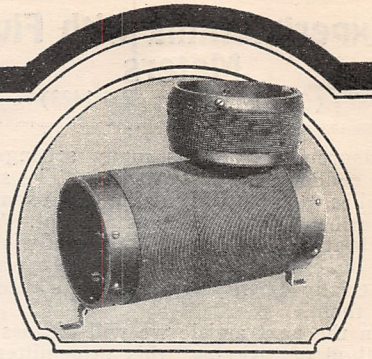
Since the company manufacturing them had little or no experience with the high voltages involved, the transformers were constantly breaking over their insulation. The same was the case with the condensers. Leyden jars were the only available form and they were none too well put together. DeForest said: "If we could only obtain good instruments. It is maddening, this inviting someone to view a demonstration only to have them see the transformer or condenser break down in the process."

Each time an accident of this sort happened, DeForest and his assistants would repair the damages, and as was ever his habit, DeForest would take notes on the method employed and the success it attained afterward, thus evolving the laws of construction. So it was only a few months until he had a fairly dependable transmitter, due to his constant work in repairing it.

It was shortly after the completion of this first one—completion meaning the repair of the transformers and condensers a dozen times—that the War Department announced they would accept bids for the erection of two wireless stations in Alaska. DeForest immediately rushed to Washington to get the specifications and to submit a bid for them. Here again he was disappointed. The bid went to a competitor. On the train returning, however, he complimented himself on being refused the bid, for immediately the extreme obstacles of the case thrust themselves before him. As it happened, these very same obstacles caused the company receiving the bid to fail, totally, on the project.

The work on the apparatus continued, however. Since his principle defect had been, in the eyes of the officials of the Department examining the apparatus, the "Sponder," he sat about trying other means of detecting the Hertzian waves. The new method took the form of an automatic decoherer. Its form was simple, consisting of two large sized aluminum wires with their upper surface roughed and a needle laid across the surface. This device, in connection with a telephone receiver, would detect the signals, but would automatically restore its conductivity at the conclusion of the high frequency wave train.

It was shortly after the perfection of this device that DeForest was invited to install one of his sets on a War Department tug boat, the "Unique," and to erect a land station on the Rhode Island coast at Ft. Mansfield. Manœuvres were to be made by a part of the fleet and the officials in charge wished to have some accurate information as to just what might be expected of radio in time

## THE AUTHORIZED COCKADAY COIL

**Specified in October Popular Radio as**

## Cockaday Precision Coil

The only coil specified by Mr. Cockaday in his New Four Circuit Tuner, with resistance coupled amplification because it meets all his specifications.

The only authorized Cockaday Coil, made in strict accordance with specifications of Laurence M. Cockaday, inventor of the famous Cockaday Four Circuit Tuner. Wound on hard rubber tubing, ⅛ inch wall, with No. 18 D.S.C. copper wire which insures selectivity, greater volume, sharp tuning and maximum sensitivity. Guaranteed.

Gets distant stations easily and clearly. Hundreds have substituted this quality coil for those of inferior make and are amazed at the improved reception, selectivity and general D-X results.

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***Approved***

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PRECISION COIL CO., INC.
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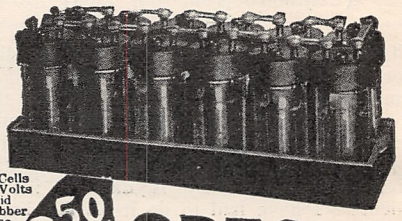

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of war. The stations were installed and two expert operators hired to read the code. DeForest stayed at the land station and supervised the work of the radio crews. During the morning of the first day of the test, he was alone. The wonder of the thing he was doing seemed to have dawned upon him as he watched the play of the sunshine on the bay, for in his diary he wrote:

"'I am sitting in our little station here, telephone to my ear, awaiting a message from our tug boat, lost somewhere on the broad waters of the Sound. Wherever it is we will hear its silent, mysterious call, speeding over waters and islands—invisible, inaudible, bodiless—yet awakening response in this tiny tube, which rests on the case before me and listens always. It is a wonderous thing, this etheric language, and when not too much engrossed in the mechanics and business of it all, the human mind is lost in admiration of its mystery.

"At times I feel a fear and a great joy that I have been called by the All Ruling to explore this great field of wonders, to summon up and listen to those silent etheric voices, which seem often less of nature than of the spirit realm. Here I sit in this bright last day of summer, the clear vault above me, the blue and peaceful waters of the ocean around me, and gaze upon the gray mists which curtain the horizon. Peacefully the white sails of ships flit slowly by, weaving in and out among the dark threads of steamers' smoke, a fabric of dreamy delight. The distant booming of guns tells me that somewhere the battle is on, the fight in which we will take a part with the signal corps. This work is my vacation, all I'll take. We'll be here another week, working night and day."

Throughout the tests DeForest kept in touch with the ships at sea, and secured perfect co-operation between the land forts and the fleet. Of course, it was only a short time after an official report of the trials were made that DeForest was called to Washington and asked to manufacture several sets for the Government. Another station was installed at the old Navy Yard at Washington, with a companion installation at Annapolis. Two-way communication was started and continued perfectly. Orders for equipment began to come in rapidly and it was only a short time, until the little new plant was turning out all the apparatus it could produce. This was the winter of 1902-03.

As the production increased there was, of course, a need for more capital with which to carry on the business. The promoters thought the time had now arrived for an enormous stride in wireless. It is a well-known law with these gentlemen that if money is to be had, the idea upon which it is to be obtained, must be constantly kept before the public. Therefore, they suggested that a station be built upon the Pacific Coast and that signals be transmitted across that great expanse of water. Easier said than done, of course, but they sent DeForest to Seattle with plans and a deed to a plot of ground on Cape Flattery. With an assistant he went to look over the ground and to map out the project in every detail.

Having had experience with much less pretentious, but sufficiently difficult projects and only a medium faith in the ability of the promoters to finance such an undertaking, he took the proposed station none too seriously. However, the foundation for the tall masts were laid and the ground mapped out.

An interesting point here, showing just how far the technical knowledge of installations had progressed at the time was that instead of selecting a point near the seashore where the best ground possible could be obtained, the highest point of a promontory had been selected. There was possibly twenty feet of earth at the top forming the


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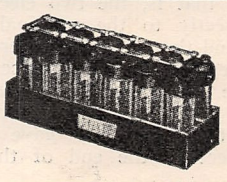

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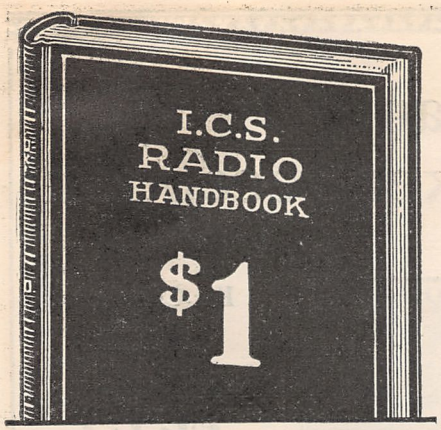


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soil, beneath that there was a strata of solid rock running down far below sea level. Any attempt to transmit with such a ground except as a counterpoise would have been doomed to failure even before it was started.

The work progressed slowly. DeForest was not anxious to finish it at that time since he had no great faith in it. He had said that "with practical every-day ranges of not over two hundred miles, an increase to more than two thousand miles is not going to be accomplished in one fell swoop.

He left the construction work to be carried out by a capable firm of engineers and returned to his work in the East. With two operators he went to Toronto, Canada, and installed a couple of stations working over a distance of forty miles consistently. One of the stations was installed in a yacht club over a lake. The lake was then frozen up for the time was mid-January. To complete this installation DeForest and his assistant went down beneath the boat house and chopped a hole through three feet of solid ice in order to get the ground plate in the lake water.

Back in New York things began again to look up. The stations installed for the Navy and Army attracted a great deal of attention and a bona fide interest in the company, and so the matter of money was temporarily eased. The most important step, at this time, however, was the establishment of a laboratory on Thames Street, New York City. Here instruments were worked over and tried and new ideas were put into practical form.

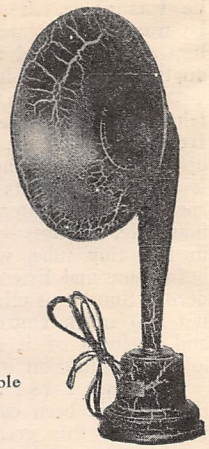
Still not satisfied with the method of detection then employed, DeForest continued his experimental work. In this little laboratory a new wireless detector was evolved. A fine platinum wire was flattened into foil and sealed into a small glass tube. Then the end of the tube was broken off and ground down so that only a small edge of the platinum foil was exposed to the acid. The glass tubes were mounted on a brass shank, which could be screwed into a holder. This holder was suspended over a lead cup which held the acid and acted as the second electrode of the detector. The whole thing was mounted on a rubber base to minimize vibration. This proved to be a very reliable type of electrolytic rectifier, based on the original discovery in 1899 by Prof. Pupin.

The Navy found these little "spade electrode" detectors suited their purpose exactly; they ordered them by the hundreds. While he thus worked, the transmitter sets of the company were making solid and constant advances. The manufacturing of them continued. The transmitter using alternating current was extremely successful. One of the principal reasons for this being probably that a very crude form of quenched spark gap was being employed. After the first few had been built, DeForest changed the conventional form of the gap and began using a split affair; that is, the two electrodes connected directly to the terminals of the transformer and the condensers were divided by an independent electrode placed between them. The electrodes themselves were in the form of large mushrooms, rounded off toward the edge. This gave a slight quenching effect at the end of the discharge.

The World's Fair in St. Louis was then a little more than a year off, and he planned to have this piece of apparatus as well as the improved receiver on demonstration there.

With the more immediate necessities out of the way, he always let his mind wander back to other problems—he may have had a very small amount of success and a very small amount of money, but he always had an ample supply of problems on hand. One of the pet ideas on which he constantly


# Ackerman Radio Loud Speaker



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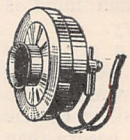

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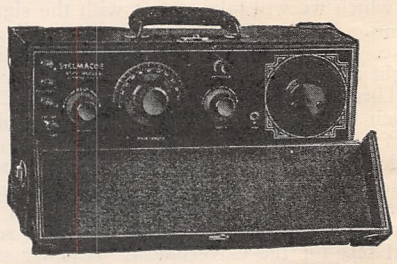

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cogitated in off hours was the reduction of his transmission method to telephony. Having already figured out that the chief necessity was the production of a super-audio frequency to be used as what we know today as the carrier wave, he made voluminous notes on methods of producing such an effect. All sorts of the most complicated high speed interruptors were designed to perform the task. But another of his chief interests was the idea which had originated with the observation back in Chicago in 1900 of the glowing gas mantle. The idea that heated gases could be utilized for the detection of electric waves had remained with him all the time, long after he and Smythe had proved conclusively that the phenomena then observed was caused solely by the sound waves in the air.

The laboratory boasted little apparatus and only the handicraft of DeForest and his assistant. One of the first experiments carried on after its establishment at 27 Thames Street was in connection with this same hunch. With a clear burning Bunsen flame he constructed a sort of detector. Two platinum wires formed the electrodes. By carefully shielding the flame from outside draughts and fixing the electrodes at the proper place in the cone of the oxidyzing portion of the jet, he found a fairly sensitive wireless detector could actually be obtained. It would work only for a few seconds at a time, however.

There was something lacking. He went back to his technical training received at Yale and remembered that the earth oxides and alkaline metals had some peculiar characteristics in connection with flame. Immediately he went to the nearest chemical house and procured a supply of potasium and sodium. He brought them back and began his work all over again. The bottom electrode was changed to the form of a spoon and the alkali metal placed in it. The results were at once surprising. The detector gained not only in sensitivity but also became more stable and seemed to work over an indefinite time, all other properties remaining the same.

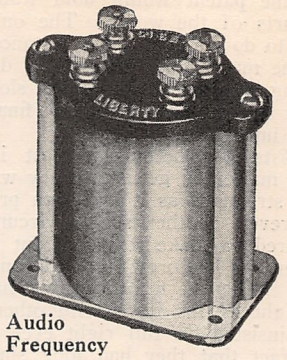
Ever the practical applications protruded itself. He saw at once that it would be impossible to work such an arrangement on ship board. Some other form would have to be evolved, if the device was to be a practical arrangement.

He was handicapped, however, in that he did not know at that time of the classical Edison experiment with the cold plate and the heated filament in a vacuum. He was still working with the rectifying effect of the heated gases in question.

On the idea that it must be used commercially, therefore, he proceeded to house the whole arrangement in a bulb, and heat it with an outside source. Accordingly, for the following several weeks his assistant, Babcock, did little but blow glass into bulbs and seal wires into them. After a time he became fairly proficient at it.

The first detector of this sort was simply two platinum wires sealed in a tube which was suspended over a gas flame or surrounded by an electric heating element. In the bottom of the bulb was a small amount of potassium or sodium. (This same idea was re-patented in 1924!)

The work on the heated gas detector continued, but the business of the company became more pressing for a season. Coast stations were slowly springing up. And there were a number of patent complications in that day even as there are in this. Fessenden was finally granted a broad patent on the electrolytic detector idea. The basic principle was held to cover all manner of devices, using acid to rectify and so note was taken of the fact that the DeForest equipment did not make use of the silver-coated platinum wire, but used the glass-

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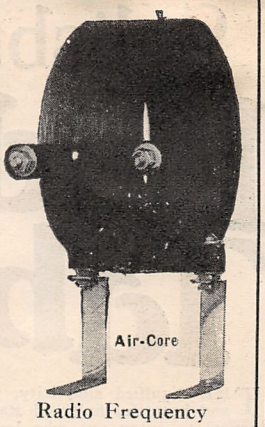

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LIBERTY clear tone transformers combined in this perfectly balanced "low loss" set make it astonish all who hear it.

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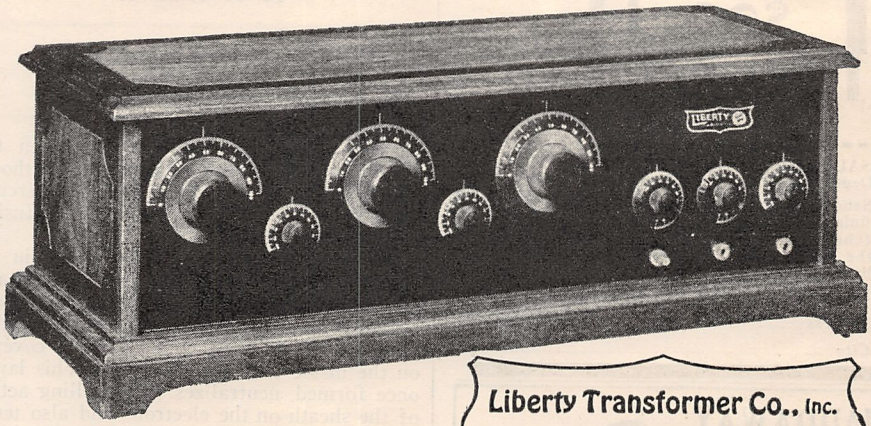


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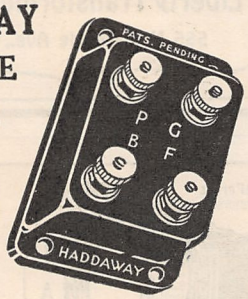


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covered "spade." There was a hurried conference of the attorneys with the resulting opinion that the patent would hold water in all the courts of the world. The only thing possible to do under the circumstances was to stop the making of this type of detector. A long patent suit began its slow unfolding over the matter and was not finally adjudicated until 1906.

The capitalists had become at last interested. The matter of getting money was not nearly as strenuous as it had been previously. However, another set of circumstances conspired to make it just about as difficult as ever for DeForest to obtain anything from it. When he first began, he had divided the right of his ideas with others. These others insisted on full right even in spite of the fact that they had long since ceased to be interested in the development work. Then there was the matter of raising the money. The brokers, according to a well-known law of finance, sought to have at least half of the money they collected for their pains in collecting it. Then there were the salaries and royalties which always made it difficult to carry a balance from one month to the next.

Apparatus that was bought from regular manufacturers was nearly always deficient in some point since they were unacquainted with the circumstances under which it had to work. Thus an added cost was necessary that was a constant drain on the resources of the company. Most of the parts had to be bought and then rebuilt at almost the purchase price. There was no end of difficulties.

As ever he was going without, enduring all sorts of personal privations for the sake of his beloved company and ideas, and was doing the work of five men. Just plodding along, fate was, temporarily interested in something else, probably. Still, things would change. There would be great success yet.

*To be continued*

## International Radio

(*Continued from page* 1411)

peculiar appearance of the arc when the sheath is positive with respect to the cathode. These ions have the dimensions of mercury atoms and of electrons, the latter diffusing much more quickly.

The negative action of the sheath in relation to the cathode (that is, when the arc is extinguished by simple contact of the sheath with the anode) is due to the jacket with which it is in contact being covered on the inside with positive ions. This layer, once formed, neutralizes the repelling action of the sheath on the electrons and also tends to rarify them in the neighborhood of the anode.

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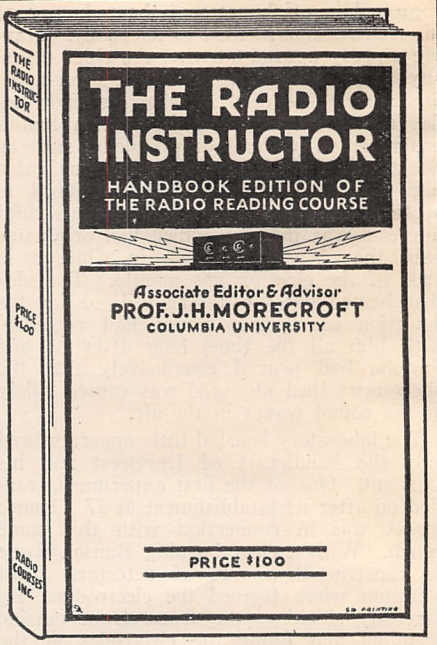
A station has been erected on a high hill overlooking the forests, so that a call for help can be issued the moment that a fire is detected anywhere.

**New Station**

With the opening of the new station at Teneriffe, France will have another link in her powerful radio chain with her colonial possessions. This station will work on a wave-length of 15,700 meters.

**Edouard Branly Honored**

Recently Edouard Branly, the inventor of the famous Branly coherer, that most important instrument in the


# RADIO'S BEST SELLER

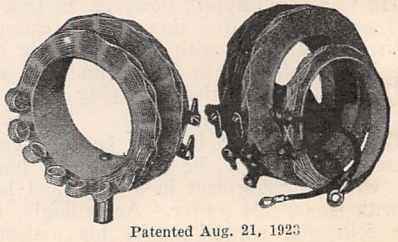
**Radio's most comprehensive reading course in one volume. Teaches the simple theory, design, construction, operation and maintenance of radio receiving apparatus in five complete lectures.**

**Leads in demand everywhere because it is authoritative and complete.**

**$1.00** *At All Radio and News Dealers or direct from*

**THE CONSRAD COMPANY., INC.**
**233 Fulton St., New York, N. Y.**





Patented Aug. 21, 1923
**PRICE $8.00 A SET**

## *for the Roberts Circuit*

Two units of remarkable efficiency, built specifically for the immensely popular Roberts Circuit. Primary and secondary coils in unit No. 1 are mounted on an insulating sleeve, with the primary coil left free to allow for adjustment in coupling.

Unit No. 2 contains primary, secondary, neutralizing coil, and tickler. The tickler is provided with 180 degree dial control. The tickler is also provided with an additional adjustment of coupling to conform to different characteristics of tubes or variations in plate voltage.

Among other popular Sickles products are the Tuned Radio Frequency Coil for self-neutralizing Tuned Radio Frequency Circuits, and the Knockout Reflex Coils. We manufacture coils for all popular Circuits and for special requirements.

*Send for Descriptive Catalog*

**THE F. W. SICKLES CO.**
340 Worthington St., Springfield, Mass.

**SICKLES** DIAMOND-WEAVE COILS

early trans-channel experiments of Senator Marconi, was tendered a banquet at the Hotel Lutetia in Paris by the Radio Club of France in honor of his eightieth birthday.

From morning till night M. Branly has combined his work as instructor in Physics with a deep research and investigation, which was crowned with its greatest success, when in 1890 he produced the famous "Branly tube"—an instrument for the reception of Hertzian waves at a greater distance than had been possible.

---

**9 Meter Set**

Lieut. Malgouzou, who has been working for the past year on the propagation of nine-meter waves for both telegraphy and telephony, has announced that he will continue his studies from aboard his ship. He intends to check up the distances that these waves carry and says that he is convinced that the nine-meter waves carry further than those of one and those of one and a half meters, used by Commander Mesny, or the 15 and 25-meter waves of the Eiffel Tower.

Another interesting phase of his work is the heterodyne receiver that has been developed for receiving these short waves, reception of which has been very difficult in the past. The new receiving set is so insensible to body capacity that the operator may put his head inside the cabinet and no interference is noticed. Lieut. Malgouzou's experimental call letters are F9OC.

---

## CANADA

**Restrain Ships from Using 450 Meter Wave**

An order has been issued by the British Government to all British ships restraining them from using the 450 meter wave-length when within 250 miles of the coasts of Canada and New Foundland, thus relieving the broadcast listener from the annoyance of interference from ship stations. Canadian ships will also follow the same practice when approaching the shores of Great Britain. Last January a similar agreement was made between the United States and Canada. The next step forward is for the Deparment of Marine and Fisheries to secure the same regulations in connection with the ships of other European countries.

---

**New Station**

Recently the new station, CNRA, of the Canadian National Railways went on the air. The station is located at Moncton, New Brunswick, and has been assigned a wave-length of 315 meters. The antenna towers of the new station are of the "Eiffel Tower" type, 150 feet high and 200 feet apart. Each tower is mounted on a base 34 feet square. The towers taper to 3 feet at the top.

---

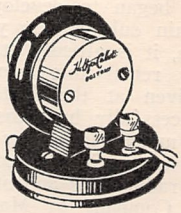
## SWITZERLAND

**1925 International Radio Exhibition**

The first Swiss National Wireless Exhibition with a limited foreign participation took place last spring. The scientific and economic success of this manifestation of radio was such that the Committee decided to give the same an annual and international character.

Consequently in September, 1925, the First International Wireless Exhibition

# A Wonderful Loudspeaker for $12.00



PHONOGRAPH ATTACHMENT $10.00

Ask any dealer to let you listen to this new Holtzer-Cabot instrument, and you will be convinced of its exceptional volume and remarkable quality of tone.

This Loudspeaker has the four factors that are necessary for entirely satisfactory reception.

Volume without distortion.
Sensitivity.
Pure Quality of Tone and
Adjustment for different strength signals.

The Holtzer-Cabot Loudspeaker, Phonograph Attachment and Headsets are the results of 35 years of painstaking manufacture.

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# NEW HOME TREATMENT FOR GLAND TROUBLE

Medical authorities agree that 65% of all men past middle age (many much younger) are afflicted with a disorder of the prostate gland. Aches in feet, legs and back, frequent nightly risings, sciatic pains, are some of the signs—and now, a member of the American Association for the Advancement of Science has written a remarkably interesting Free Book that tells of other symptoms and just what they mean. No longer should a man approaching or past the prime of life be content to regard these pains and conditions as inevitable signs of approaching age. Already more than 20,000 men have used the amazing method described in this book to restore their youthful health and vigor—and to restore the prostate gland to its proper functioning. Send immediately for this book. If you will mail your request to the Electro Thermal Company, 6042 Main Street, Steubenville, Ohio—the concern that is distributing this book for the author—it will be sent to you absolutely free, without obligation. Simply send name and address. But don't delay, for the edition of this book is limited. Western Office, Dept. 60G, 711 Van Nuys Bldg., Los Angeles, Calif.

24 Pages OUR NEW 2400 Items

# CATALOGUE

JUST OFF THE PRESS

Is the most complete list of **Radio Sets and Parts** ever published and contains prices on material for building all the latest circuits such as

**Super-Heterodyne - Teledyne**
**Ultradyne - Cockaday Superdyne**
**Neutrodyne**
**Harkness Reflex**
**Erla Reflex**

and many others.

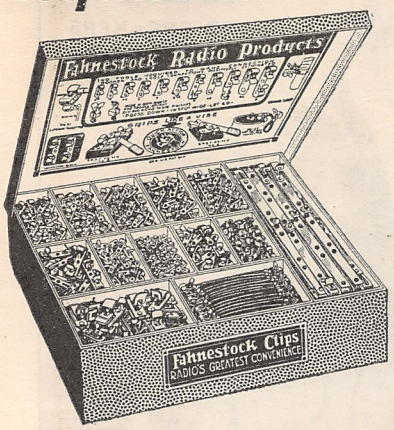
It also contains prices on many "hard to get" special parts such as

**Litz Wire, Screws, Brass Rod, Tools, Engraving Rotors, Washers, Hex Nuts, Phosphor Bronze Wire, Choke Coils, Lavite Resistances, Pig Tail Wire and hundreds of other important items.**

Send 10c and we will send you one of these Catalogs. 10c refunded first purchase.

SIMPLEX RADIO SALES CO.
1804 Lafayette Ave., St. Louis, Mo.

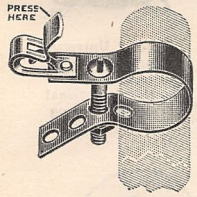
# For Every Radio Requirement—




## —there is a proper FAHNESTOCK Clip

FAHNESTOCK solderless connectors are made in 47 styles and sizes designed to cover a multitude of requirements and are in every case undoubtedly the best for the particular need.

The display case illustrated contains 14 varieties, which have been proven by past sales the most popular with the radio buying public. Wide awake dealers everywhere are enjoying increased business by installing these display cases, which show the prospective purchaser instantly the type of connector best suited to his needs.




**Improved Ground Clamp**
Equipped with Fahnestock Patent Wire Connectors Easily Attached.
No Soldering—
For Radio Use Only

**ASK Your Dealer to tell you about the FAHNESTOCK Antenna Connector, which assures a Perfect Connection.**

*None genuine without our stamp*

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**LONG ISLAND CITY, N. Y.**



**NAA Get 'Em** 60¢

The only scientifically selected detector minerals on the market today are the genuine N.A.A.

**METER TESTED RADIO CRYSTALS**

Full, clear rectification insured by newly developed visible laboratory meter-testing. Perfect for reflex. Price 60c at your dealer or direct. Recommended by Radio News, Popular Radio, Acme Apparatus Company, etc.

The Newman-Stern Co.
1740 East Twelfth Street
Cleveland, Ohio
Pioneers in Tested Crystals


will take place at Geneva in the halls of the "Palais Electoral." This time has been chosen because of the excellent reception that is possible in the autumn and also because it is the time that the League of Nations will meet.

**Hoengg Station**

Preliminary trials from the new broadcast station at Hoengg, near Zurich, have proved very satisfactory and reception from this station is reported in both England and Sweden. Their wave-length is 650 meters, but this may be soon altered as it intereferes with marine and coastal traffic.

### EGYPT

**Policy Changed**

The Egyptian Government has recently discontinued the issuance of radio experimental licenses. This action has given rise to many rumors, one of which is that the government contemplates the granting of a monopoly to a company to be formed in Egypt. This monopoly could then exploit broadcasting in many ways, one method being to compel the listeners-in to buy their sets from the company, in addition to paying a license fee.

### SPAIN

**Interest in Radio Growing**

Although radio interest began to develop in Spain only a few years ago, it is already attaining remarkable proportions. The plays given at the National Opera have been successfully broadcast in Madrid. There are many plans now for establishing broadcast stations in some of the larger cities, some by radio clubs and others by the Radio-Iberica Company of Madrid. The Madrid station of the latter is frequently heard in France, and operates on a wave-length of 392 meters with a power of one kilowatt.

### GREECE

**Greeks Use Private Radio**

Radio telephony has been utilized by a number of business houses in Greece, where the radio regulations permit the private use of this means of communication. Four large firms are already equipping their premises with a radio telephone outfit to link up their head offices in Athens with branches. This type of set is as easy to operate as an office telephone.

### RUSSIA

**Outdoor Radio Concerts**

The Moscow crowds are now treated to open-air radio concerts by means of a system of seven loud speakers, which are placed in various parts of the grounds of the "Peoples' House." These loud speakers pick up the Moscow concerts and give them to a large crowd which assembles nightly to listen in.

### DUTCH EAST INDIES

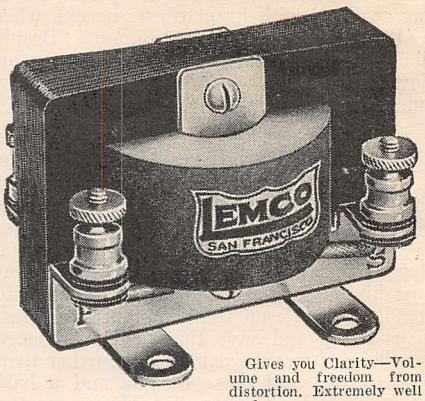
**Prohibitory Laws Modified**

In response to the ever increasing pressure from the public for the general use of radio, it is believed that the existing law will be modified some time in the near future to permit the installation of receiving sets.

Under the present law, the installation of both radio broadcast and receiving equipment


**$3.50 LEMCO EQUIPMENT**

**AUDIO TRANSFORMER**




Gives you Clarity—Volume and freedom from distortion. Extremely well made.

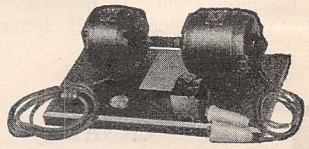
Sent postpaid upon receipt of purchase price.

**LEE ELECTRIC & MFG. CO.**
220 Eighth St., San Francisco, Cal.

Dealers—Jobbers Write for good proposition.



**OHIO MOTOR GENERATOR CHARGER**



**BATTERIES ALWAYS O. K.!**

It's the fully-charged storage battery that brings in those radio programs clear as a bell.

Keeping your storage battery full of Power is easy with the Ohio Motor Generator Charger.

Merely hook it to a light socket. Fully automatic, needs no watching while charging and cannot charge in the wrong direction. Charges in **one-third** the usual time at 3 to 20 amperes, 6 to 10 volts, so you need never lose an evening's entertainment because of run-down batteries. Regularly equipped with 110 volt, 60 cycle A. C. Motor, 6 to 10 volt Generator.

Equipped for other service if desired. Ohio Motor Generator Sets can be made double voltage for charging both "A" and "B" batteries.

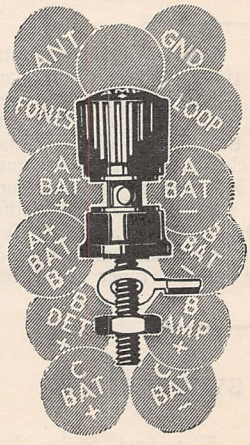
**SATISFACTION GUARANTEED OR MONEY BACK**

In writing for details and special prices, state service current and if Charger is to be used for "A" batteries only or both "A" and "B" batteries.

**The Ohio Electric and Controller Co.**
**5970 Maurice Avenue, Cleveland, Ohio**



**Establishing a New Standard!**




The New and Improved

**"Read' Em" Binding Posts**

*"The Knobs Can't Come Off"*

NEW MARKINGS FULFILL EVERY DEMAND

The Utmost in Quality at

**15c**

*At Your Dealers or Sent Postpaid.*

**The Marshall-Gerken Co.**
**Toledo, Ohio**



Insure your copy reaching you each month. Subscribe to RADIO NEWS — $2.50 a year. Experimenter Publishing Co., 53 Park Pl., N. Y. C.

is prohibited. The entire question of radio telephony is being discussed throughout the colony, and while definite information is not available at this time, it is generally believed that the increasing agitation for the use of radio will result in the abolishment of the restrictive law within the next year.

An exception to the law prohibiting receiving equipment is the large receiving station of the "Aneta" Press Service recently opened in Batavia.

**New Station**

This station is used for receiving press news from abroad, but all information passing through it is carefully censored, by government officials prior to release. The Aneta station will be prepared to furnish a radio service for all of the Dutch East Indies as soon as broadcasting is permitted. It is understood that an addition to its present function as a news receiving station Aneta has been established and designed with a view to broadcasting later on.

Northern Sumatra will have no trouble in listening in on this station. There are no stations affording entertainment service sufficiently near to be heard in Sumatra, although reports are current that stations will soon be established in Singapore and other stations within receiving radius of this part of the world.

### POLAND

**New Station**

A company with French backing is being organized in Poland to install at least one broadcast station and possibly more. It is hoped to interest the Poles in local broadcasting. From present reports, it seems that the European banks find foreign exchange bulletins and financial news the most valuable work radio companies are doing.

### JAPAN

**Freedom for Japanese Amateurs**

For some months Japanese amateurs have been waging war with certain authorities who have endeavored to curtail freedom of reception under the pretext of securing secrecy for official messages.

An official regulation has been issued, however, allowing greater freedom for amateurs, and wireless traders are now preparing a vigorous campaign.

### GERMANY

**Radio for Aviation Fields**

A law has been passed calling for installation of a radio set on every aviation landing ground. The set must be capable of receiving meteorological bulletins from all parts of Europe and of communicating with all passenger planes while in the air.

**Uses Metronome to Tune In**

The Breslau broadcast station has established a loud-ticking metronome in its station. This is operated for some time before the regular program is sent. This enables listeners to distinguish clearly the loudness of the signals and permits a sharp tuning in, after which news or concerts are broadcast.

**German Radio Exhibition**

The building that is to house the German Radio exhibition is the only one of its kind in the world. This large edifice was built in Berlin especially for showing the


OPERADIO

The Truly Wireless Radio

A Set Which Will Revolutionize Your Ideas of Radio

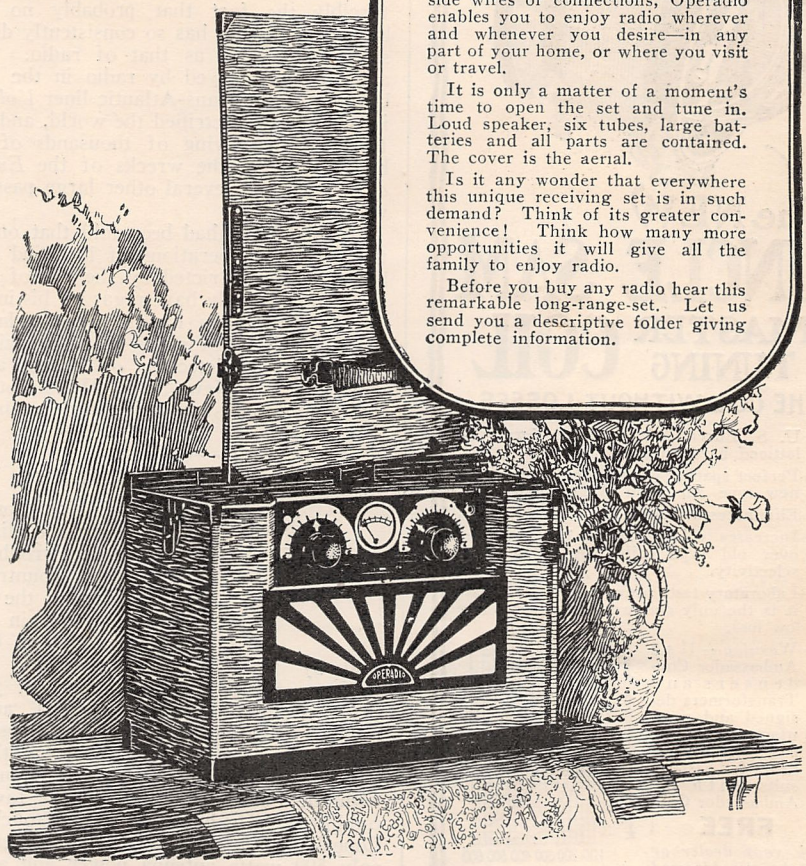
Until you hear the 1925 Operadio you cannot fully realize the tremendous advances recently made in radio reception.

Here is a powerful set of exceptional efficiency engineered to such compact proportions that it can be carried anywhere. Requiring no outside wires or connections, Operadio enables you to enjoy radio wherever and whenever you desire—in any part of your home, or where you visit or travel.

It is only a matter of a moment's time to open the set and tune in. Loud speaker, six tubes, large batteries and all parts are contained. The cover is the aerial.

Is it any wonder that everywhere this unique receiving set is in such demand? Think of its greater convenience! Think how many more opportunities it will give all the family to enjoy radio.

Before you buy any radio hear this remarkable long-range-set. Let us send you a descriptive folder giving complete information.

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The Operadio Corporation

8 So. Dearborn St. Chicago, Ill.

RADIO CATALOG

100 Live Pages

Crammed full of Biggest Bargains in Sets, Parts and Accessories—

FREE

Contains interesting explanation of marvelous benefits of Radio which you may enjoy—told in language anyone can understand. You should get it before buying.

Everything you may need to build or equip any set. Satisfaction or your money back.

*Don't Delay!*

Send for it TODAY!

Liberty M. O. House, Dept. B679 106 Liberty St., N.Y.C.

HERCULES Aerial Mast

*All Steel Construction*

Painted black complete with galvanized steel guy wires and masthead pulley. 20′ mast $10, 40′ mast $25, 60′ mast $45. We pay freight. Ideal for receiving or transmitting. Greater range. More satisfactory results. Write for literature and large

FREE BLUEPRINT

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2048 E. 79th St. Cleveland, Ohio

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Largest exclusive Radio Jobbers in middle West.

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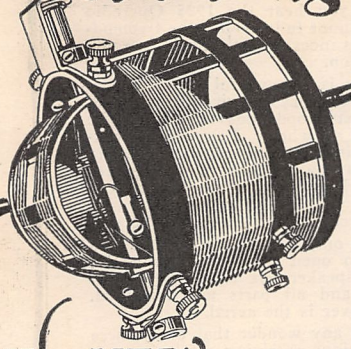
Go into business for yourself

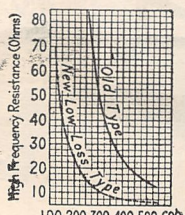
Make storekeepers' profits without storekeepers' troubles or expenses. No investment necessary. We furnish everything and carry all stock for you. We have started hundreds of men who are now making $4,000 to $10,000 a year. We can do the same for you. Write for facts at once. Address Dept. 516, GOODWEAR, Chicago, Inc., West Adams St., at Peoria, Chicago.

wonderful! startling!



The NEW
UNCLE SAM
MASTER TUNING COIL
THE COIL WITHOUT LOSSES

1—U. S. Bureau of Standards forms of latticed hard rubber.
2—Perfect spacing of each turn because of new type American Ambassador Litz.
3—Eliminates adhesives.
4—Increases volume 50 to 180 per cent over old type coils. Also improves selectivity.
5—Laboratory tests prove conclusively that it is the only coil worthy of the name low loss.
6—*Warning*—Use Ambassador Condensers and Transformers designed and manufactured by Ambassador Engineers for best results with the Ambassador Coil.

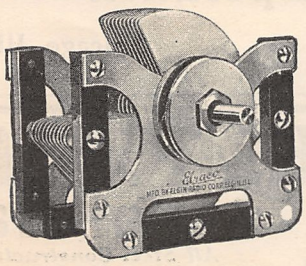



**FREE**

*Ask your dealer or send self-addressed stamped envelope for wiring diagrams of circuits in which this remarkable coil can be used.*

**UNCLE SAM ELECTRIC CO.**
**211 E. 6th St., Plainfield, N. J.**





The new, remarkable
ELRACO
Low Loss Condenser

leads the field. Grounded rotor. Single hole mounting. Brass plates. Practically no loss. Correct in design and construction.

.00025 M.F. $4.50 .0005 M.F. $5.00
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***Satisfaction Guaranteed***

ELGIN RADIO CORPORATION
*Radio Division,* The Elgin Tool Works, Inc.
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marvels of radio. It is constructed throughout of wood, there being as small an amount of iron and steel in the building as possible. There have been provisions made for soundproof rooms, so that manufacturers of loudspeakers and sets may let the public judge for themselves the merits of the products.

### AUSTRALIA

**Radio Police Car**

The dramatic christening of the Radio Motor Car attached to the Police Department at Sydney, brings home very forcibly the fact that probably no other branch of science has so consistently demonstrated its value as that of radio. Years ago the part played by radio in the tragic burning of the trans-Atlantic liner *Volturno,* in mid-ocean, electrified the world, and there followed the saving of thousands of lives by radio from the wrecks of the *Empress of Ireland* and several other large passenger vessels.

If Bill Sykes had been told that one day the nocturnal operations of his kind would be seriously restricted by the aid of radio, he would probably have regarded his informant as a harmless lunatic. Yet today, we find the science of radio linked up with the prevention or detection of crime, a new departure for New South Wales, but one that has already amply justified its installation.

### GREENLAND

**Danish Government Station**

Radio is doing one important work in eliminating the wire troubles of the northern countries, as is shown by the work now going on in establishing stations in Greenland by the Danish Government. Three stations are on the west coast (at Julianshaab, Godthaab, and Godhaven), and the fourth on the east coast of Argmagssalik.

Julianshaab, with 5 kilowatts in the antenna, is for the purpose of communication with the Faroe Island, and under favorable conditions it is hoped to get in touch with Copenhagen. Godthaab and Godhaven have only 500 watts antenna power and are for local communications, while Argmagssalik will be for meteorological work with Reykjavik, some 450 miles away. The latter will be principally for the aid of the fishermen, having 1½ k.w. antenna power.

The entire work is being done by Danish engineers and workmen, and most of the material used was made in Denmark.

### ARGENTINA

**Broadcast Resumed**

When a broadcast station interferes with governmental communication, its owner's and operator's licenses are suspended. Recently most of the broadcasters were shut down by the Minister of Marine for such interference. But following conferences and investigations, the press declared that the President had exceeded his authority and general broadcasting was resumed. Action on the part of the government is awaited with considerable interest.

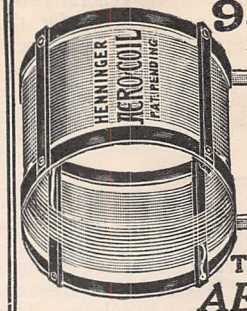
Amateurs have to pass a government examination before they are licensed to operate.

### A CORRECTION

Through an error in our printing department, the illustrations in the advertisement of the Express Body Corporation on page 1038 in the December issue of RADIO NEWS were reversed.

The price of Cabinet No. 29 should have been $7.50 set up complete in carton and the price of Table No. 31 should have been $3.50 packed in carton.


Here's the Newest!




95% AIR DIELECTRIC
NO DOPE USED ON WINDINGS
The Henninger AERO-COIL
PAT. PENDING
PREVENTS R. F. LOSSES

Here is the greatest, most important advancement in Tuner and tuned R. F. Transformer construction ever made. Think of it! A rigid self-supporting Tuner and tuned R. F. Transformer having 95% air dielectric, and with no dope on the windings. The Aero-Coil *actually* uses and amplifies hundreds of times, the energy *lost* by "doped" coils or coils wound on tubing.

$3.50 Postpaid

Replace your old coils with Aero-Coils. You will get *enormous* volume on distant stations; reception will be crystal clear—your set will tune "needle" sharp. You will be amazed at the difference. Primary 6 1-4 turns; secondary 60 turns; beautifully made. Go to your dealer now and get a set of Aero-Coils. If he hasn't them yet, send us the purchase price with your dealer's name and we will send the coils and brackets postpaid at once. $3.50 each or $10.50 set of three. Also write for bulletin H-3 "Radio Frequency Losses and their Prevention"—It's FREE!

THE HENNINGER RADIO MFG. CO.
1772 Wilson Ave., Dept. 16, Chicago
DEALERS and SET MANUFACTURERS: Write for Attractive Proposition.



*Guaranteed Parts For "Radio News" Circuits*

**Ideal Low Loss Broadcast Receiver**

| | |
|---|---|
| 1—7x21 in. Radio Panel | $2.65 |
| 1—Low Loss Tuner | 10.00 |
| 1—.0005 Duplex Low Loss Variable Cond. | 5.50 |
| 1—E-Z Toon 4" Vernier Dial | 2.25 |
| 4—Benjamen Cle-ra-tone Tube Sock. $1 ea | 4.00 |
| 1—.00025 Mfd. Fixed Grid Condenser | .35 |
| 1—2 Megohm Grid Leak | .50 |
| 1—.5 Megohm Grid Leak | .50 |
| 2—.1 Megohm Grid Leaks 75c each | 1.50 |
| 2—.05 Megohm Grid Leaks 75c each | 1.50 |
| 1—.005 Megohm Grid Leak | 1.00 |
| 3—No. 41 Daven Resisto Couplers $1.25 ea | 3.75 |
| 1—51 Daven Mounting | .50 |
| 1—30 Ohm Rheostat | 1.25 |
| 1—6 Ohm Rheostat | 1.00 |
| 1—Filament Switch | .30 |
| 1—Single Circuit Jack | .50 |
| 6—Eby Binding Posts 20c each | 1.20 |

**Tu Ra Flex Receiver**

| | |
|---|---|
| 2—.00035 Cardwell Condensers $4.75 each | 9.50 |
| 1—Fixed Coupler (Selectoformer) | 5.00 |
| 2—2¾" dl. 2" long Bakelite Tubes 60c ea | 1.20 |
| ½ lb No. 26 Single Cotton Magnet Wire | .60 |
| 2—Precise Audio Freq. Trans. $5 ea | 10.00 |
| 1—R.U.F. Crystal Detector | 1.35 |
| 1—7x18" Radion Panel | 2.25 |

A 10% discount will be allowed on all orders for $25 and 15% on orders for $50 and over.

WHOLESALE MORISON Electrical Supply Co. Inc. RETAIL
17A East 40th St., New York



Hundreds of miles with Roll-O Crystals

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Dept. 30, Cincinnati, Ohio

# Helpful Hints for Radioists

By Y. Z. MUTS

### LEAD-IN WIRES

EVEN though the lead-in wire is insulated, never let it touch metal objects such as the coping around the roof, fire escapes, etc., as energy will leak through the insulation and cause partial short circuits in that the aerial will be partially shorted, thereby cutting down on signal strength. Place all wires through porcelain tubing, where there is any possibility of it touching metal objects.

### OBTAINING MORE VOLUME

If you wish to obtain more volume from your present receiver, the use of the UV-202, five-watt tube, in the last audio stage will prove a wonderful performer. This tube draws considerable current, however, so be sure to use the proper rheostat. Use a six-ohm rheostat. W. E. VT-2 tubes will also perform very well for power amplification.

### RECKONING THE UPKEEP

The upkeep and expense of a radio set varies in proportion to the number of tubes in use. There is little expense attached to the set itself. Replacement of batteries is the main item that enters into the cost of operation. A five-tube set should be considered five times as expensive in upkeep as a one-tube set. The upkeep expense of a crystal set is practically nil, as nothing must be replaced except an occasional crystal costing from 10 to 15 cents.

### HOW TO "HARD DRAW" SOFT COPPER WIRE

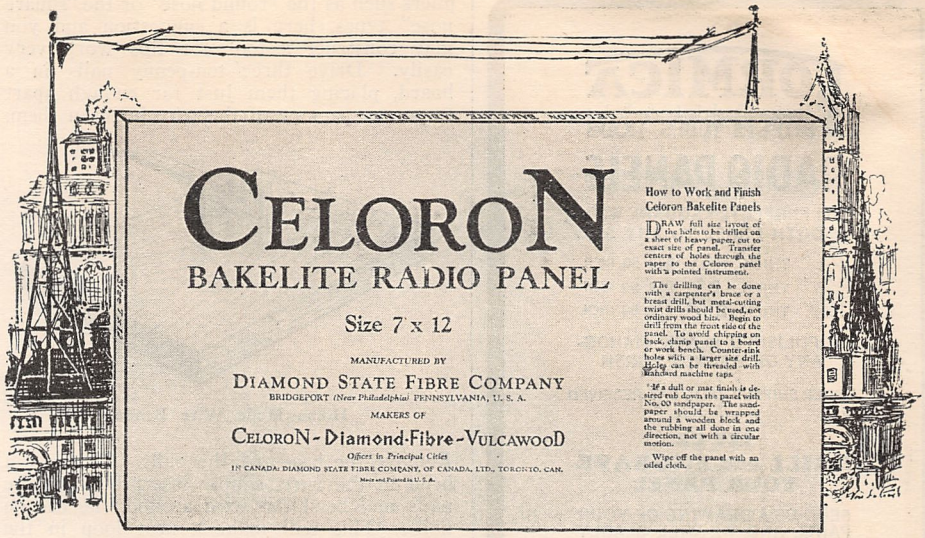
Have you ever tried wiring a set with "hard drawn" copper wire? You can "draw" the wire yourself. Procure either No. 12 or 14 wire which generally comes in coils. Cut off a piece about 20 feet long. Insert one end in a vice and close the vice tight. Then take hold of the other end of the wire and pull hard—as hard as you can, until the wire is tightly stretched. The wire is now "hard drawn" and you can cut it into convenient lengths, say, about two feet each. You will find the wire quite stiff, and it can form some neat angles. If the wire is hard when bought, place the coil in a small flame and let it get quite hot. Then put the coil quickly in water. This will cause the wire to become fairly hard, when it may be "drawn" as described.

### CLEAN ANTENNA INSULATORS LESSEN LEAKAGE

There is much discussion around that it is advisable to take down your antenna periodically and clean off the insulators. From the broadcast fan's standpoint this sounds foolish, but from a technical view it is logic. The best type of insulator for use on an outdoor antenna should be corrugated and it should be a highly glazed or polished surface. A highly glazed surface presents a high surface resistance and the corrugations lengthen the distance that any current will have to travel to leak off. Now if dust or other elements of the air settle on the glazed surface of the insulator, the surface resistance is lowered and leakage will commence. Therefore, it is wise to clean the insulator periodically. When erecting your antenna make provisions for lowering it. During the dry weather leakage will not be as great as in wet weather.

### TOOLS FOR BENDING WIRE EASILY MADE

The use of bus for wiring in receiving sets is becoming the established method. A great many fans find it rather difficult to make a neat job of it, due to lack of pliers, or the lack of knowledge as to how to bend the wires. Should you have no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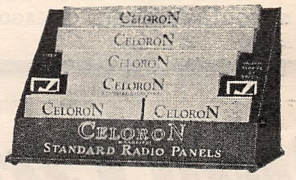


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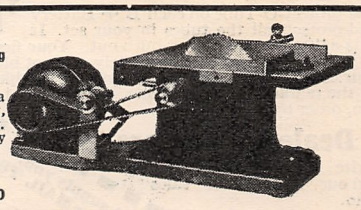

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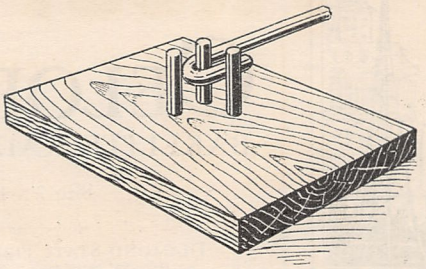
pliers such as the "round nose" or the "square nose" types, here is a suggestion and you may construct a tool for this work very easily. Drive three ten-penny nails in a board, placing them just far enough apart to permit passage of the wire between them.



Home Made Wire Bender

Remove the heads of the nails. To make a bend in the wire, simply insert between the nails and bend the wire around one of the nails. This will make a neat loop in the end of the wire.

### SOMETHING TO REMEMBER

Never tear apart a manufactured set and try to build a different hook-up from the parts. The parts from a manufactured set are unsuited for any other use than that for which they were primarily intended.

### NEVER SOLDER ON MOLDED SOCKET, UNLESS BAKELITE

Never solder the wires on a molded vacuum tube socket, unless you are absolutely sure that it is made of bakelite, as some of them are made of a composition that will melt as soon as the heat of a soldering iron is brought in contact with it.

### METERS AID IN TESTS

In an effort to improve both the appearance of their sets and to read the condition the batteries are in, many radio fans have bought either a voltmeter or an ammeter or both. For fans who are contemplating the purchase of either one of these meters, I suggest they procure a milliammeter having a scale reading from zero to 25 millimeters. If weak or no signals are heard in the phones and the meter does not give any indication of current flowing when connected in series with the "B" battery, then the trouble lies in the plate circuit. Just which tube the trouble lies in may be traced by using the meter on each tube separately. If current does not flow as per usual or slightly less, take a "C" battery and connect it in series with each grid circuit. If a decrease is noted in the meter reading on all tubes but one, then the trouble lies in the grid circuit of this tube.

### NUMBER OF PLATES NOT AN ACCURATE GAUGE

It very frequently happens that when a certain number of turns of wire and a certain number of plates are specified for the coils and condensers in radio sets, one such receiver will cover the waveband nicely while another will not. Naturally, the novice wants to know why. In many instances the explanation lies in the fact that the number of plates is no accurate gauge of the capacity of a condenser. One 23-plate condenser may show the usual .0005 mfd. capacity; another of the same general design might test as low as .00015 mfd. or as high as .00055 mfd.

### THROW THE SWITCH

If the set "won't work" when the tubes are turned on, take a look at the aerial switch. Maybe it hasn't been closed. You will be surprised how many "experts" overlook this little item. When the set tunes more sharply than usual, this may also be the cause. It's just like hunting for trouble in a motor car —and finding it at last in an empty gasoline tank.

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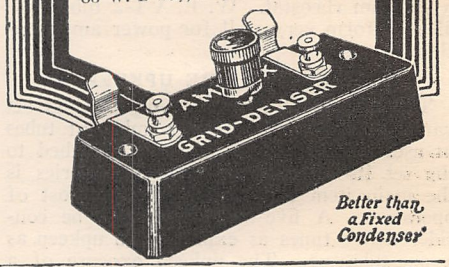


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storage battery may refuse to show a hydrometer reading above 1,225 or 1,230. There may be a perfectly good reason for the failure of the battery to show a higher specific gravity reading. One reason is that the charger may not be working. If you have connected up the charger with reversed polarity, the battery will be run down instead of charged. If you have a broken wire in the circuit from the charger to the battery, the tube will still light, but no current will be sent to the battery. When you have made sure that the charger is operating properly, and have left it on charge until the specific gravity fails to come up higher, you may then assume that your battery may be in need of attention. Take the battery to a service station and instruct them to discharge the battery, replace the electrolyte with new and recharge. Do not attempt to do this yourself for several reasons. The first is that you are not prepared for this work. Mixing acids is a very dangerous game to yourself and your clothing, and the expert knows the strength of electrolyte to use and is prepared to do this kind of work.

### CONCERNING CRYSTALS

So far it has been proven that the adjustable variety of crystal detectors are far more serviceable than the fixed types. Why be ashamed of a crystal set? There are thousands of users of one, two, three and even eight tube sets who are not able to receive any but the local stations, and surely any crystal set can do that. The quality of reception cannot be equaled. The choice of a crystal is important. So far no one has seemed to produce any fixed crystals as good as the adjustable varieties. Many fixed crystals are good, however, and especially with strong signals of the reflex they do give more or less satisfaction. A galena crystal may be a wonder when you hit the right spot, but by that time the operator may be so exhausted that its wonderful qualities can't be fully appreciated.

### MOON CAUSES VARIATION IN RECEPTION

Due to the fact that the moon's position varies with its phases, you will observe that reception changes with the phases. In the first quarter, the reception is best in the early evening and the signals are generally loudest from western stations. As the moon changes its phases around from the first quarter to the full moon, the reception becomes better later in the evening when the moon is at its full height. This change in reception is approximately 50 minutes later each evening, just as the tides of the ocean vary 50 minutes. At that critical period when the moon changes from full to no moon at all, reception becomes poor.

### CLEAN IRON WHEN SOLDERING JOINTS

Every radio outfit requires soldered joints which will not pull apart or add high resistance paths in the circuit and making a soldered joint is quite easy, provided you have a good, clean iron and the proper soldering compound. The easiest way to keep the iron clean is to wipe it thoroughly before it is used to solder a joint. When the iron gets dirty or corroded from too much heat, it may be rubbed with a lump of sal-ammoniac. It will show up brightly. An electric soldering iron is preferable to the gas-heated iron and stays hot longer.

### TEST FOR SOURCE OF NOISE IN RECEIVER

The first thing to do when noises are heard in the receiver is to make sure that they are not originating in the receiver itself. An informative test is to connect the antenna and ground terminals of the receiver with a piece of wire. This prevents any voltages from the antenna from actuating the receiver, and if the noises are still heard


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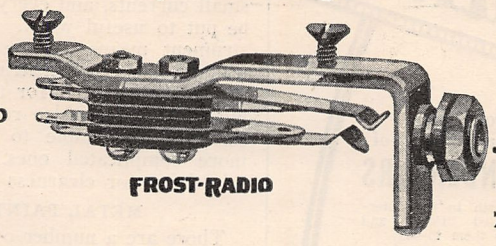


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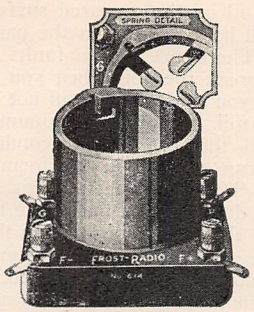


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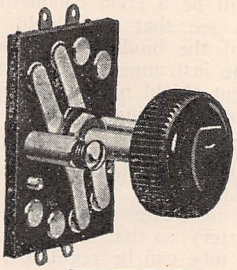

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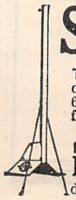

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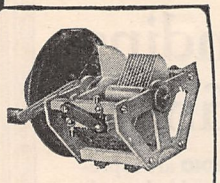

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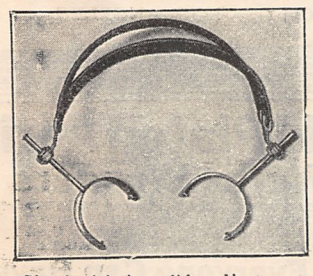

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it is absolutely certain that they are being caused within the receiver, and are not coming by way of the antenna. When such a connection is made on a receiver which is in good condition, perfect silence in the loud speaker (or headset) will be had.

### UNESSENTIAL INSTRUMENTS CAUSE LEAKAGE

When buying parts, always bear these facts in mind: A receiving set handles very small currents, and every bit of energy must be put to useful work. Each additional instrument means so much more chance for leakage. Use no instruments that are not absolutely essential for the proper functioning of the set. Also remember that simple sets are less liable to cause trouble than more complicated ones. Do not sacrifice selectivity for clearness and distance.

### METAL PAINT SHIELD

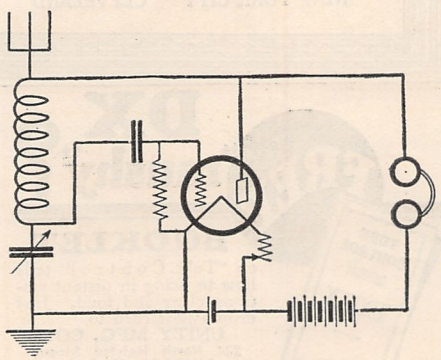
There are a number of methods of shielding a radio set; the most popular is the tinfoil method. This is done by coating the back of the panel with shellac or varnish and carefully laying thin sheets of copper foil or tinfoil on the prepared surface. The varnish will hold the foil to the panel when it dries. There are many faults to this. You may break the foil when you are putting it on; you must be careful not to wrinkle the tinfoil. Copper, aluminum or any other metal that is a good conductor of electricity can be used in the form of thin sheets of 1/16 inch or less. This shield is much more durable; you must take the panel down to do this, and drill holes in the sheeting for the various shafts and screws. The effective method is the paint method. Secure some aluminum or bronze paint (such as is used for radiators). Mix this paint until it is fairly thick and then apply with a camel's hair brush to the back of the panel. Do not spare the paint as you want a surface that will be a good conductor. With any method see that the shield does not touch any of the binding posts, screws or shafts of the instruments, yet be sure that the instrument shield makes a good contact with the ground binding post.

### HEATING OF THE RHEOSTAT

The heating of a filament rheostat is no cause for alarm. The very purpose of such a device is to waste some of the current from the battery, so that the amount flowing through the tube can be regulated. The retarded electricity is dispatched in the form of heat.

### LONG WAVE RECEPTION

For those who are aching to hear European stations, which are doing experimental broadcasting on from 1,100 to 1,800 meters, the ultra audion circuit, using a honeycomb coil, offers a flexible outfit. The size of the coil will depend on that of the condenser used, but the coil may be changed to suit the wave-length sought. This set is a transmitting hook-up and a steady radiator of energy when oscillating, so that its use on broadcast waves is a nuisance, but with the small number who now tune to above 1,000



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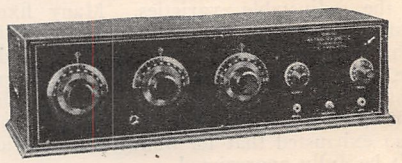
Will You Get London?



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meters, it will not create much interference. With suitable coils, this set will work up to the highest commercial code stations handling trans-Atlantic traffic.

### ADJUSTING CONDENSER

Many owners of receivers have heard of the beneficial effect of connecting a condenser across the secondary of an audio frequency transformer. Doing this clears the signals considerably, but at the same time cuts volume to a great extent. There is one good point about such a procedure, though it is not realized. It allows the audio frequency side of the circuit to stand much more current flow than would be possible, were it not used. Therefore, when connecting a condenser across the transformer, always place more plate voltage in the circuit of the tube, which has the condenser in it. The larger the condenser used, the greater the reduction in volume will be. An extra 22½-volt "B" battery will usually bring the volume up to the original point, and the clarity will be improved considerably.

### TUBES FOR PORTABLE SETS

When buying a set for any portable work where it will receive a lot of jolting, see that the tube sockets are mounted on shock-absorbing bases, preferably spring mountings. Otherwise the tube filaments will be shaken to pieces, or will at least set up their customary noise.

### NECESSITY OF VERNIERS

To accurately tune a set, verniers are essential. Small vernier condensers are helpful, but an even finer vernier is better. One of the simplest and most efficient verniers that can be used is the one that will be described herein. With this vernier one complete revolution of the dial through a 90-degree variation of the dial through a 90-degree arc will give the same length variation, as that given by a one degree variation on the tuning condenser or variometer. This consists of a loop of No. 14 D.C.C. wire made small enough to rotate inside the tube holding the secondary tuning coil. This loop should be mounted on a wooden shaft cut from a quarter-inch dowel pin. The loop is connected in series with the end of the coil it is nearest to. To operate the vernier, the loop is rotated.

### BENT HEADPHONE DIAPHRAGM CAUSES POOR RECEPTION

If you wear the headphones for long periods of time, it is often a good plan to remove the caps and wipe off the moisture that has collected on the metal diaphragm. This avoids the possibility of rust formation. Be very careful while doing so that you do not bend the thin, little disk. Telephone receivers often develop troubles of their own. If signals cannot be heard on one set of headphones, it may be possible that the metal diaphragm is resting on the pole pieces of the magnet. It may also be that the tip of the phone cord has become loosened from the inside of the receiver case. Unscrew the molded cap from the receiver case. Carefully slide off the diaphragm by two fingers placed on top of the disk and drawn towards the edge of the case. Lay the diaphragm down on a flat surface, and if not bent, it will lay perfectly flat.

### CRYSTAL CUTS EXPENSE

The upkeep expense of a radio set depends on the number of tubes used to meet all the other necessary requirements. Sets using a crystal detector and four amplifier tubes draw only half as much current, as sets using a soft vacuum tube detector and four amplifying tubes.

### TUBE SOCKET IMPORTANT

Second only in importance to the tube is the tube socket, for all the energy must

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*60 cycles—110 volts*

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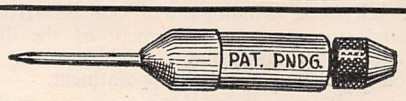


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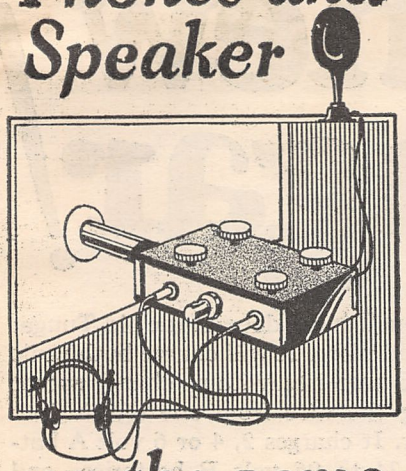
# Phones and Speaker



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One plug now serves for *both* phones and speaker. Both are permanently connected—and the handy switch shifts reception from one to the other instantly! A big step forward in plug design! You'll wonder why you ever put up with inconvenience of two separate plugs!

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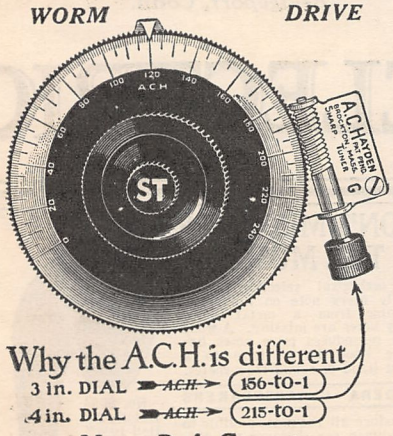


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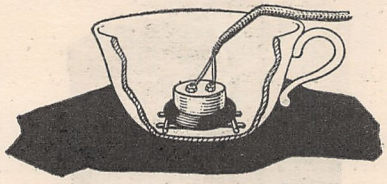
pass through the socket before it passes the tube. Indications are that the metal shell socket will soon become as obsolete as the single slide tuning coil. The best radio engineering practice of today calls for the elimination of as much material as possible in the neighborhood of the parts of the radio set which carry the radio frequency current.

### LOUD SPEAKERS IMPROVED

An emergency loud speaker can easily be made by putting each telephone receiver of a headset in an ordinary china cup, with



Emergency Loud Speaker

the ear cap down. The volume obtainable is often astonishing. Round cut glass bowls or wooden chopping bowls are also quite effective. If the bottom of the dish is rather flat, the phone must be propped up by a couple of match sticks.

### PRECAUTION

When completing a new set it is advisable to try out the connections with a single tube, preferably a cheap bootleg or worn out tube, by changing it from socket to socket, rather than take a chance of blowing several good tubes all at once.

### ALWAYS REMEMBER

A separate "B" battery on the third step of radio frequency amplification will often eliminate the squeal when using three stages. In regenerative sets, begin tuning for the station with regeneration at zero, and when the station is heard increase regeneration until the signal is at its loudest. When using a soft tube, be sure and have a vernier rheostat. A low voltage "A" battery usually results in weak signals.

### PREVENT CORROSION

Vaseline placed on the terminals of a storage battery will prevent their corrosion and will insure a good connection at all times, if battery clips are used for this purpose. White or yellow vaseline may be used.

### HEADPHONES IN SERIES

It will be found that when two pairs of phones are to be used on a set, if the phones are connected in series the signal strength will not be materially reduced, but if connected in parallel the signal strength will fall to almost half its original value; therefore, connect the phones in series.

### VALUE OF PHONES

The phones are the necessities of a good set. If the phones are poor, it will be impossible to receive long distance stations, because the weak current that flows through the telephone windings will not be strong enough to actuate a movement of the diaphragm. Be sure that the phones are of good make and avoid disappointment.

### AVOID OSCILLATIONS

Never let a receiving set get into an oscillating condition while tuning it; oscillation means radiation, and radiation means trouble and annoyance for all the neighbors operating sets. Oscillations are controlled in most circuits by turning down the filament and by reducing regeneration. In radio frequency sets it is usually eliminated by potentiometer adjustment, reduction of filament current or by reduction of plate current.

### CLEANING RADIO PARTS

The ordinary pipe-cleaners which can be obtained in packages of two dozen or more for a few cents are invaluable to the amateur who wishes to get the most out of his set. Folded in half they form excellent con-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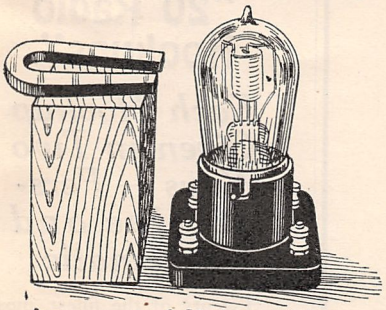
denser cleaners, allowing the dust to be eradicated from all corners. They also can reach all places which it is impossible to get at with fingers and pliers, and will collect all the fuzzy dust and dirt.

### MAGNET HELPS VOLUME

An ordinary horseshoe magnet can produce some interesting effects in connection with a vacuum tube. The magnet placed closely, with the field passing through the



Arrangement of Magnet and Tube.

area of the grid and plate of the tube will retard or assist the passage of the charged bodies across the intervening space. Regeneration can, in a measure, be controlled in this way.

### LOSS OF PEP

When your detector "B" battery is new you may find that the tube functions best at, say, 19½ volts. You connect the lead there and forget it, and later begin to wonder why the set is losing pep. Quite possibly it is because the "B" battery has run down considerably in the meantime, and the 19½ volt tap now gives only 18 volts. In that case matters are easily remedied by using the next higher tap. This applies chiefly to dry batteries, since storage cells retain practically their full voltage until exhausted.

### JACK TROUBLE

Very often after completing a two-stage amplifier it is found that it is impossible to hear anything in either the detector or first stage of amplification, but very satisfactory results will be had in the second stage. When such a condition exists, it is usually trouble in the jacks, and an examination will show that the phone plug does not make proper connection with the prongs of the jack. The best way to overcome this difficulty is to use a different size washer between the jack and the panel.

### IDEAL SOLDERING FLAME

A tablet of Hexamethylenamine, or to use the easier name, Urotropin, will furnish an ideal soldering flame in an emergency. A five-grain tablet when lighted with a match will burn for three minutes with a steady, pointed, smokeless, odorless blue flame of an intense heat. The seven- and ten-grain tablets will burn proportionately longer.

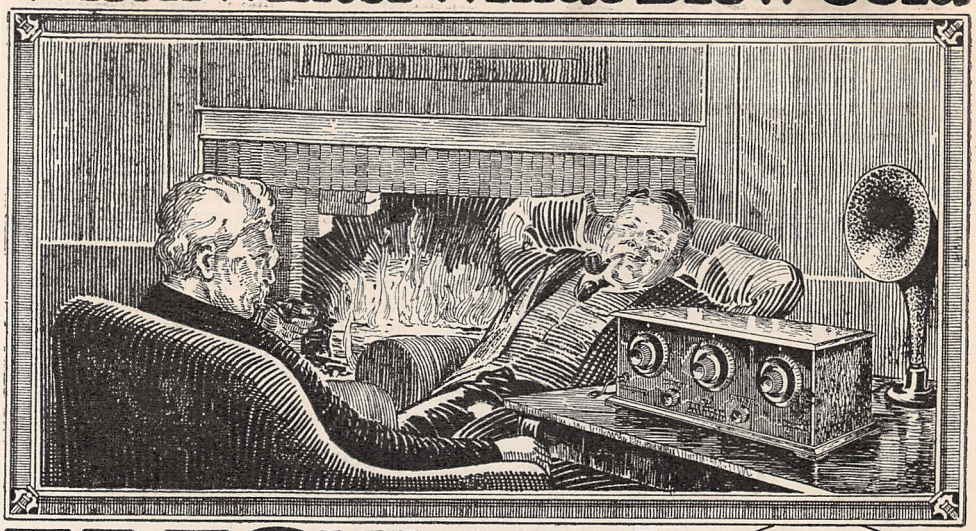
### RUBBER COVERED WIRE

The wires used to make connections from the storage batteries to the receiving set should not be insulated with a cotton covering, as the acid in the battery is apt to attack the insulation and cause a short circuit of the battery. Heavy rubber-covered wire with a tarred canvas outside covering is best suited for this purpose. The size wire to be used in the filament battery circuit depends largely upon the number of tubes used in the receiver. No 14 gauge wire will answer all cases admirably.

### LEAK ON TRANSFORMERS

There is another use for a high resistance unit other than as a grid leak. This is an absorber of low frequency noises usually prevalent in audio frequency amplifiers. The resistance should have a value of one quarter of a megohm, and can be used on a noisy amplifier. The unit should be connected across the secondary of the transformers.


# When Winter Winds Blow Cold



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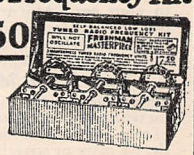

**It's Easy to Build**

a five tube radio frequency receiver when you use the Freshman Masterpiece Kit. The result will be a receiver that will bring in even the most distant stations with the volume and clarity of locals. The equal of any 5 tube set in selectivity, simplicity of operation and all around efficiency.

*No Neutralizing or Balancing Condensers Required*

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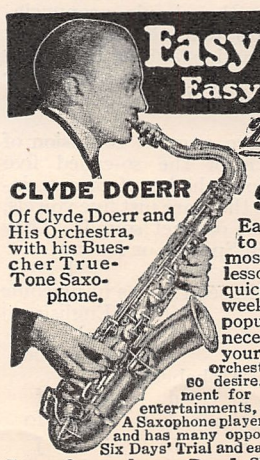

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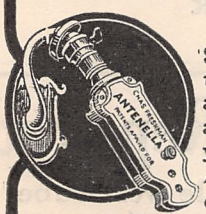


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Why pay $10.00 or more to have an aerial spoil the appearance of your home? Antenella eliminates all unsightly wiring, lightning arresters, etc., and precludes the possibility of dangerous grounding on a power line. It also stops "canary bird" re-radiation from nearby oscillating sets interfering.

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**Chas. Freshman Co. Inc.**
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### POTENTIOMETER AID

A potentiometer connected across the "A" battery and with the center arm connected with the negative end of the "B" battery will aid in gaining fine control of regeneration, if a soft detector tube is used. It is seldom that much effect is noticed if the potentiometer is placed in a set using a hard tube for a detector. The potentiometer should have a resistance of at least 200 ohms. More resistance gives better control and less current taken from the "A" battery.

### MAKE PORTABLE SETS SAFE

Numerous suggestions for portable summer radio sets mention use of a suitcase for the cabinet and container. The shape and size are good, but the builder will do well to make sure that the leather sides are stiff. The average suitcase will offer no protection against jars and jolts. If wooden sheets are fitted into the inside of the suitcase, forming a sort of wooden box within the leather, the added rigidity will protect the set to a large degree.

### SOME SELECTIVITY!

*First Radio Fan*—Say, I tuned in darn near every European station, and take it from me I have a real tuning set.

*Second Fan*—Tuning set! Say, you don't know what tuning is. I got Rome, Italy, on my set; there was a band concert on and I tuned out all the instruments except the cornet and enjoyed a fine cornet solo. That's tuning.

*—Contributed by H. W. Codding.*

## Lessons in Esperanto

*(Prepared especially for* RADIO NEWS *by James Denson Sayers, Esperanto writer and editor, President of New York Esperanto Harmonio Club)*

### LESSON 1.

IT IS impossible to obtain mastery of a national language elsewhere than the country where it is spoken. The peculiarities and eccentric variations of pronunciation make the learning of it impossible except through constant use. This is one of the insuperable obstacles to the adoption of any national language as the auxiliary world language.

Such difficulty is distinctly absent from Esperanto, the neutral auxiliary world language created by Dr. Ludwig L. Zamenhof during 15 years of painstaking research. Its pronunciation and grammar are so simplified and regular that anyone with a common school education can master it at home. Especially is this true where a group of two or three or more can study together, giving each other the benefit of hearing the words pronounced by another, thus training the ear. If group study is not possible, the isolated individual student should, after carefully mastering the simple pronunciation, read Esperanto text aloud. By such method, the ease of understanding Esperanto when first heard from the lips of a foreigner or any good speaker will be startling and delightful.

In English we have a great confusion of vowel sounds, each of the so-called five vowels having various shades of pronunciation. In Esperanto there are just five vowels, each having just one distinct sound. They are pronounced as in Spanish or Italian:

| A | E | I |
|---|---|---|
| as in farther | as in send | as in machine (long English ee) |
| **O** | | **U** |
| as in more or soar | | as oo in too |

The Alphabet

| **a** | **b** | **c** | **ĉ** | **d** | **e** | **f** |
|---|---|---|---|---|---|---|
| ah | boh | tso | cho | doh | eh | fo |
| **g** | **ĝ** | **h** | **ĥ** | **i** | **j** | **ĵ** |
| go | Joe | ho | hho | ee | yoh | zho |
| **k** | **l** | **m** | **n** | **o** | **p** | **r** |
| ko | lo | mo | no | oh | po | ro |
| **s** | **ŝ** | **t** | **u** | **ŭ** | **v** | **z** |
| so | sho | toh | oo | oo-oh | vo | zo |


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The consonants have the same value (sound) as in English except the following: C as ts in cats, **Caro** (Czar) ts-ah'-roh. Ĉ as ch in church, **ĉe** (at) **chay.** G invariably as g in go. Ĝ as g in gem, **ĝojo** (joy) joh'-yoh. J as j in hallelujah, jes, pronounced as and meaning same as English "yes." Ĵ as s in pleasure, measure, **mangaĵo** (a food) mahn-jah'-zho. S invariably light, as s in so. Ŝ as sh in she or show. Ĥ, used in only a few words, pronounced as ch in Scotch or German, or as j in the Spanish word "reloj." If difficulty is found with this sound, no confusion will be caused by pronouncing it as k until its pure sound is learned. It is a valuable sound because of its strength.

**Aj,** ah-ee, pronounced quickly, practically as one syllable, **kaj** (and) kahee or kyee. Oj as oy in boy. Ej as ey in obey. Uj as uj in hallelujah. Ŭ, being a consonant, simply adds the noun ending to the vowel U, and is called oo-oh, but has the same value or sound in words as the vowel, except that in the few words in which it appears, being a consonant, it has no influence on the accent.

Accent is invariably on next to the last vowel, or syllable.

The grammar consists only of 16 basic rules; the verbs are all regular, having just 12 conjugations. The parts of speech are formed on basic root words by regular letter endings. Thus nouns end in o; adjectives in a; verbs end with i (infinitive) and adverbs end with e.

Plural of nouns is formed by addition of j: **Patro** (paht'-roh) father, **patroj** (paht'-trohy) fathers. Adjectives agree in number with their nouns: **Bona patro,** a good father, **bonaj patroj,** good fathers.

The present tense of the verb is formed on the basic stem by the ending -as, thus: **La patro parolas,** the father speaks.

The definite article, the, is la, pronounced lah. There is no indefinite article, a, in Esperanto. **Bona patro,** a good father; **granda tablo,** a large table, etc.

| | |
|---|---|
| **la,** the | **bona,** good |
| **paroli,** to speak, to talk | **granda,** large, big |
| **knabo,** boy | **veni,** to come |
| **urbo,** city | **birdo,** bird |
| **arbo,** tree | **kanti,** to sing |
| **brili,** to shine | **varma,** warm |
| **patro,** father | **sur,** on or upon |
| **rapide,** rapidly, fast | **suno,** sun |
| **de,** of or from | **varme,** warmly |

Reading Exercise

**La bona patro parolas. La granda hundo kuras rapide. La knabo venas de la urbo. La birdo sur la arbo kantas. La suno brilas varme. La bonaj patroj parolas. La grandaj hundoj kuras rapide. La knaboj venas de la urbo. Granda hundo kuras. Bona knabo parolas.**

Translate into Esperanto

The good father speaks rapidly. A large boy runs. The dog comes from the city. The sun shines warmly. The large boys run rapidly. The good fathers speak warmly. The birds on the trees sing. A good dog comes from the city.

LESSON 2.

Cases

There are only two cases in Esperanto, nominative and accusative, the latter known as the direct objective case in English grammar. The accusative is formed by the addition of n to the nominative: **La viro skribas leteron,** The man writes a letter; **Johano batas la hundon,** John beats the dog. Superficial students of Esperanto object to the accusative ending n, declaring it unnecessary. But deeper students learn that it is extremely valuable, in fact, that it is one of the points of genius in the language. The forms of speech, or syntax, of different languages are often very dissimilar. However much the national language forms differ, there is never ambiguity in Esperanto, even if the national syntactical forms are used. We can say: **Johanon mordas la hundo,** or, **La hundo mordas Johanon,** meaning clearly in both


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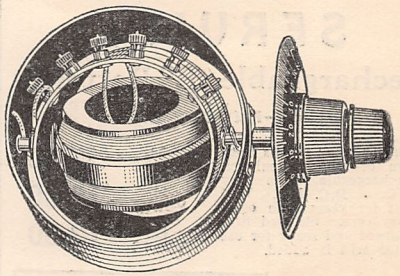

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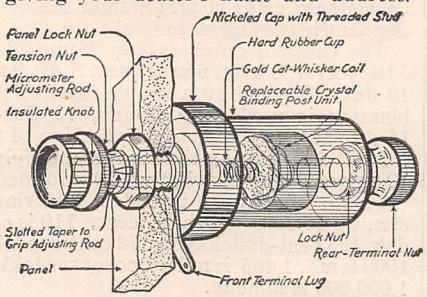


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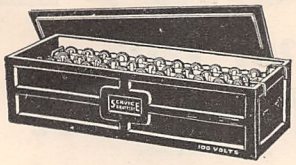

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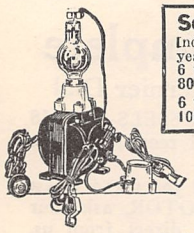

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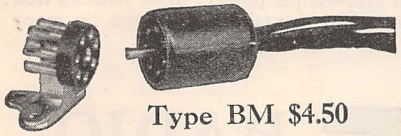

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that: The dog bites John. This is rather a simple and forced illustration of the value of the accusative ending, but as one progresses, more complicated and appropriate examples of its value are often encountered.

The accusative does not usually follow a preposition: **Mi aĉetis la libron de li,** I bought the book from him. **Mi portis duonan funton da sukero.** The accusative follows prepositions only when they show motion. This is called the accusative of direction: **Mi iris trans la straton,** I went across the street, but: **Mi staris trans la strato,** I stood across (on the other side) of the street, no motion indicated. **Li iris en la domon,** He went into the house, but: **Li marŝis en la domo,** He walked in the house (He was inside the house already as he walked).

More treatment of this very useful accusative ending will be given in a following lesson.

The days of the week: Sunday, **dimanĉo;** Monday, **lundo;** Tuesday, **mardo;** Wednesday, **merkredo;** Thursday, **jaŭdo;** Friday, **vendredo;** Saturday, **sabato.**

Months: **januaro, februaro, marto, aprilo majo, junio, julio, augusto, septembro, oktobro, novembro, decembro.**

Learn the days and months here, as they will not be given in the vocabularies hereafter.

(The names of the days and months are usually written with small letters.)

**Comparatives:**

The comparative is formed by **pli ol,** more than: **La elefanto estas pli granda ol la hundo,** The elephant is larger than the dog.

The superlative is formed by **plej,** the most. **La elefanto estas la plej granda besto,** The elephant is the largest animal.

The cardinal numbers are: **1 unu,** 2 **du,** 3 **tri,** 4 **kvar,** 5 **kvin,** 6 **ses,** 7 **sep,** 8 **ok,** 9 **naŭ,** 10 **dek.** Beyond 10 a simple form of combination is used: 11 **dek-unu,** 12 **dek-du,** 16 **dek-ses,** etc. The multiplication of tens is formed by placing the number multiplying 10 before the work **dek,** thus 20 is formed by "two-ten **du-dek,** 30 is **tridek,** 50 **kvindek,** etc., up to 100, which is **cent.** 110 is **cent-dek,** 125 **cent-dudekkvin,** 178 **cent-sepdekok.** 1000 is **mil.** 1,465 is **mil kvar cent sesdekkvin.** 1,000,000 is **miliono.**

The ordinal numbers are formed by adding the adjective ending to the cardinals, thus: **Unu,** 1, **unua,** first; **sepa,** seventh; 85th, **okdekkvina,** etc. When used adverbially, the ordinal numbers change the ending to the adverbial form instead of the adjectival: Firstly, **unue;** thirdly, **trie;** fifthly, **kvine,** etc.

Multiples, where formed by -fold in English, such as fourfold, tenfold, hundredfold, etc., are made by the suffix **obla:** Double, Double, **duobla;** threefold, **triobla;** tenfold, **dekobla,** etc. Used adverbially, change the ending to adverbial: Doubly, **duoble;** fivefold (-ly), **kvinoble,** etc. A double quantity, **duobla kvanto,** He is threefold stronger than the other man, **Li estas trioble pli forta ol la alia viro.**

Fractions are formed by the suffix -ona added to the stem of the cardinal form: one half, **duono;** one third, **triono;** one tenth **dekono.** These are used as adjectives or adverbs by changing the ending: One half part of the apple, **Duona parto de la pomo;** one tenth part of the money, **dekona parto de la mono. Duone,** by halves; **dekone,** by tenths.

Distributives formed by the prefix **po,** at the rate: At the rate of ten dollars per day, **Po dek dolaroj tage;** At the rate of two dollars each, **Po du dolaroj por ĉiu. Pogrande,** at wholesale.

Collectives formed by the suffix, **-op:** By twos, **duope;** They went in fives (in groups of five each), **Ili iris kvinope.** The soldiers marched single file, **La soldatoj marŝis unuope.**

**The Pronouns**

The personal pronouns are:

| | |
|---|---|
| **I, mi** | we. **ni** |
| you, **vi** | you, **vi** (plural) |

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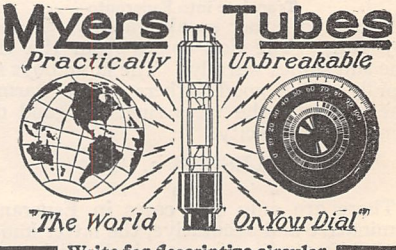

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| | |
|---|---|
| he, **li** | they, **ili** |
| she, **ŝi** | **oni,** one, they (abstract, impersonal) |
| it, **ĝi** | **si,** himself, herself, etc. (reflexive) |

The possessive pronouns, being adjectives, are formed by the adjectival ending:

**Mia,** my, mine. **Via,** your, yours. **Lia,** his. **Ŝia,** her, hers. **Ĝia,** its. **Nia,** our, ours. **Via,** your, yours (plural). **Ilia,** their, theirs. **Sia,** his, her, their own, etc., (reflexive).

**Si,** reflexive pronoun, deserves a paragraph all by itself, because it is a highly valuable little word with which to avoid confusion. It is a pronoun of the third person, and cannot refer to pronouns of the first and second persons. We cannot say **Mi lavas sin,** or **ni** or **vi lavas sin** for I, or We, or You wash ourselves. In each of these cases we must use the pronoun which is the subject of the verb, as **Mi lavas min; Ni lavas nin; Vi lavas vin. Si** refers only to the third person and always refers back to the subject of the clause in which it stands: **Li razis sin,** He shaved himself. **Mia fratino havas amikinon, kiu faras ĉion por si, kaj nenion por ŝi,** Meaning: My sister has a friend, who does everything for herself, and nothing for her. In the English form there is ambiguity, but the Esperanto is very clear because **"si"** refers back to the subject of its clause, the pronoun "who," which stands, of course, for "friend."

The possessive pronouns are adjectives and take pural and accusative endings to conform to the nouns they belong to:

**Las knabo amas siam patron,** The boy loves his father.

**La knaboj amas siajn patrojn,** The boys love their fathers.

**Liaj floroj estas belaj,** His flowers are beautiful.

**Mi sendis mian monon,** I sent my money.

**Oni aplaudis vian kanton,** Your song was applauded, (one, or they applauded, etc., abstract sense).

### Past and Future Verb Tenses

The simple past tense of the verb is formed by the ending **-is** added to the stem, or root, of the verb, replacing the present tense ending **-as:** I sent the money, **Mi sendis la monon.** He went to the city, **Li iris al la urbo.**

The future tense is made by the ending **-os: Mi sendos la monon,** I shall send the money. **Li iros al la urbo,** He will go to the city. (Care should be used to enunciate the verb endings clearly, in order that confusion of the tense be avoided. A little care at the start, in order to acquire the habit of clarity and preciseness, will suffice.)

### Vocabulary

**antaŭ,** before
**tago,** day
**dum,** during
**esti,** to be
**koni,** to know a person, to be acquainted with
**havi,** to have
**hodiau,** today

**manĝi,** to eat
**aĉeti,** to buy

**butero,** butter
**komercisto,** merchant
**por,** for, in order to
**strato,** street
**marŝi,** to walk, march
**libro,** book
**vesti,** to dress
**porti,** to bear, to carry, to wear clothing
**al,** to, towards
**pli,** more
**frato,** brother
**ami,** to love
**plej,** most

**iri,** to go
**funto,** pound

**kvanto,** quantity
**vendi,** to sell
**ĉiu,** each, every
**sed,** but
**alta,** tall
**interesa,** interesting
**el,** out of
**ankau,** also

**aparato,** apparatus, set
**ol,** than
**Eŭropo,** Europe
**car,** because
**viro,** man
**fali,** to fall

**aĝo,** age
**devi,** to be compelled to, must
**en,** in
**da,** of (part of mass quantity)
**sukero,** sugar
**cendo,** cent
**lau,** along, according to


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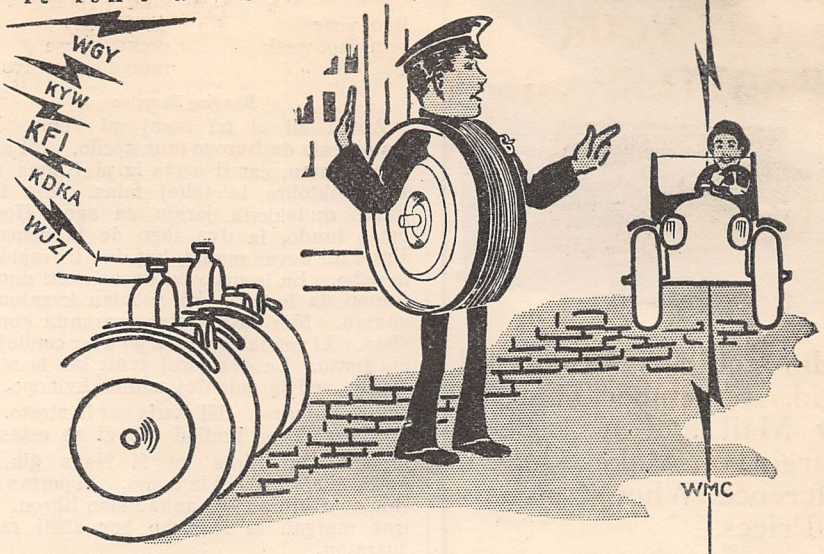


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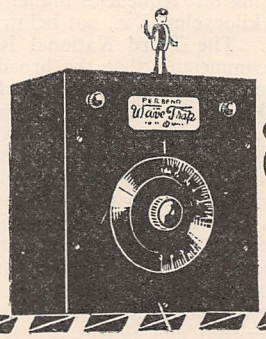


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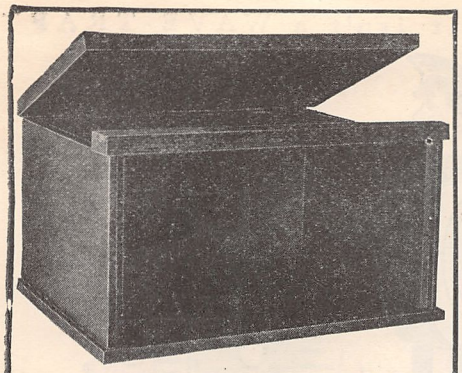

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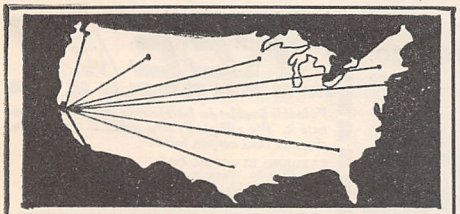

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NORTH—Received coils OK today. If I have same results with these that I had with last will be wanting more. I am 1,500 miles from nearest station and have picked 56 to date, Chicago, Havana, Mobile, New Orleans and TWO IN ENGLAND.——Lunenburg, Canada.

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**WHY NOT** spend Spring, Summer and Fall gathering butterflys, insects? I buy hundreds of kinds for collections. Some worth $1 to $7 each. Simple outdoor work with my instructions, pictures, price-list. Send 10 cents (not stamps) for my Illustrated Prospectus before sending butterflies. Mr. Sinclair, Dealer in Insects, Dept. 37, San Diego, Cal.

folio, leaf
jaro, year
semajno, week
soldato, soldier
stari, to stand
diri, to say
domo, house
morgaŭ, tomorrow

Reading Exercise

Antaŭ pli ol tri tagoj mi venis. Mia frato venis de Eŭropo dum aprilo. Mi amas mian fraton, ĉar li estas la plej bona viro. Dum oktobro la folioj falas. Mia frato havas dudekkvin jarojn da aĝo. Hodiau estas lundo, la dua tago de la semajno. Unue mi devas mangi, kaj due iri rapide al la urbo. En la urbo mi devos aĉeti duonan funton da butero, kaj duoblan kvanton da sukero. Mia patro estas pogranda komercisto. Li vendas sukeron po kvar cendoj por ĉiu funto. La dek viroj venis laŭ la strato duope, sed la soldatoj marŝis kvinope. Ili estas altaj viroj. Ni staris sur la strato. Ŝi aĉetis la libron hodiaŭ sed ĝi ne estas interesa. Oni diras ke ŝi legas ĝin. Ŝi vestis sin kaj iris el la domo. Li portas sian (his own) libron kaj ankau ŝian libron. Mi iros morgaŭ al la urbo por aĉeti radioaparaton.

Translated to Esperanto

He will go tomorrow. His father is the best man. I bought the book. She brings her (sian) book. They say (one says) she is tall. Ten men marched by twos. He bought a double quantity. The radio set is large. He is a good man, but his (sia) father is the best man. January is the first and June is the sixth month. He will speak first (firstly), and I will speak secondly. He sells sugar wholesale at the rate of five cents a pound. I bought half a pound of butter.

## Latest Broadcast News

### TUNING IN ON SHORT WAVE STATIONS

The Bureau of Standards has issued the following note on methods of adjusting your receivers to short wave or high frequency stations:

"Some broadcast receiving sets now in use can not be tuned conveniently to stations broadcasting on frequencies higher than 1,000 or 1,200 kilocycles, *i. e.*, not below 300 or 250 meters. The Third National Radio Conference recommended that the broadcast band of frequencies be extended to 1,500 kilocycles (200 meters). This emphasizes the importance of the production of sets which will tune conveniently at the higher frequencies, and the desirability of information on how to use existing sets so that all stations may be tuned in. The range of receiving sets which employ a single tuned circuit, (*i.e.*, where the antenna is part of the tuned circuit) may be extended to the higher frequencies without much difficulty. This applies both to crystal and tube sets. It can be done very simply by providing a fixed condenser (about .0002 microfarad) in series with the antenna which may be switched in or out of the circuit. The settings of the dials are different when the condenser is in and out of circuit. Shortening of the antenna likewise reduces the capacitance and consequently increases the maximum frequency (minimum wave-length) to which the set will tune.

"In the two-circuit and other more complicated receiving sets the extension of the frequency range may not be so convenient. A general rule, however, may prove useful. The natural frequency of a circuit is determined by the product of the inductance and capacitance in the circuit, the larger this product, the lower the frequency (higher the wave-length). To increase the frequency to which a circuit will tune it is only necessary to decrease either the inductance or capacitance or both. The inductance may be reduced by reducing the number of turns,

**Burns**

**LOUD SPEAKER**

Distinctive in design

Pyralin bell
Aluminum column

*Volume—Clarity—Beauty*

No. 205B—Polished black flare.... $22.50
No. 205D—Shell pyralin flare..... 25.00
No. 100 —Phonograph unit ..... 10.00

Manufacturers

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**POLYPLUG**

**Positive Contact Always Maintained**

Simply slip the Polyplug into the loud speaker or head phone socket and a positive contact is maintained regardless of pulls, jerks and jars on the phone cords, assuring uninterrupted and clearer reception of programs. All unsatisfactory features of screw type plugs are eliminated. The tension slot, an exclusive feature, makes the Polyplug the most convenient and efficient plug made.

It's genuine Bakelite, too

*At all reputable dealers*

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**NEW YORK**

75¢ WORTH IT



**PATENTS**

To the Man with an Idea

I offer a comprehensive, experienced, efficient service for his prompt, legal protection and the development of his proposition. Send sketch, or model and description, for advice as to cost, search through prior United States patents, etc. Preliminary advice gladly furnished without charge. My experience and familiarity with various arts frequently enable me to accurately advise clients as to probable patentability before they go to any expense.

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**RICHARD B. OWEN**
PATENT LAWYER
2 Owen Building, Washington, D. C.
2276A Woolworth Bldg., N. Y. City

while a reduction in the number of plates or increase in spacing of the plates reduces the capacitance of a condenser. The effective capacitance in a circuit may also be reduced by using two condensers in series. Changes in receiving sets of this type can, in general, be readily made by radio listeners who construct their own sets."

## NEW YORK POWER MAGNATES DISCUSS RADIO INTERFERENCE

The large electrical power and light companies of New York State are beginning to find an interest in the radio interference created by leaks in their lines, according to a report from their convention held recently at Syracuse, N. Y. Elimination of the interference caused by leakage should be undertaken without delay by the companies, it was urged in a subcommittee report rendered at the closing session of the Empire State Gas & Electric Association. F. H. Hill, General Manager of the Elmira Water, Light & Railroad Company, and A. C. Jordan, General Electric Superintendent of the same organization, sponsored the report.

One of the greatest difficulties encountered by the companies which already have tried to eliminate such interference, the report pointed out, was to obtain adequate apparatus speedily to locate the source of interference.

The revenue which lighting companies receive from radio users who sit up late at night and therefore keep the electric lights aglow was cited as one of the primary reasons why the companies should interest themselves in the welfare of the radio enthusiasts. Prediction was made that before long all of the current required for operation of radio sets would be drawn from the electric light sockets.

"There is at present in this country one installation of radio control substation," the report continued, "and it is going to be but a short time before someone in every lighting company is going to be responsible for the operation of their own radio apparatus. What better training can there be than to assist customers to locate their present troubles?"

## LARGE STATION ESTABLISHED IN LITHUANIA

It has been reported to the bureau that the Lithuanian Government is erecting a large station on one of the hills which surround Kovno, Lithuania. It is expected that the station will be ready for operation within the next few months. The antenna will be a fairly large one strung from two towers which will be 492 feet high. A radio service with all Europe for Lithuania is expected to be the result of this station.

## ANOTHER USE FOR RADIO VISION

Another application of C. Francis Jenkin's radio vision has been discovered: A means for deaf and dumb people to communicate over long distances. If radio vision is perfected, moving pictures of the transmitter's hands could be flashed through space, while he was manipulating his fingers to make the deaf and dumb alphabet. On the screen the receiver could read the letters and phrases just as he would from the moving fingers themselves, and in turn would transmit his reply, making practical a deaf and dumb telegraph system.

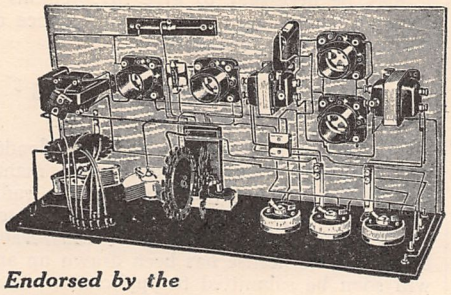
Mr. Jenkins is having some difficulty, however, with the practical use of his radio photography and radio letters due to interference with broadcast reception. Recently, while sending some radio letters from the Naval Station at Bellevue, D. C., to the radio show at Wardman Park Hotel in the early evening, a number of complaints from indignant fans came in. They objected to


# See What Doubleday, Page & Co.

***Through Mr. Arthur H. Lynch, Editor of their magazine, "Radio Broadcast"***

## Say about the Radio Broadcast's Sensational 4-TUBE KNOCK-OUT SET

***Developed by Walter Van B. Roberts***



"Tube for tube, dollar for dollar, result for result, we will stack it up against any receiver for home construction *ever described* by any radio publication and gamble that it comes out winner."

***Endorsed by the***

**Canadian Government**

and recommended to Canadians as the best, after exhaustive competitive tests and with a complete knowledge of performance. *Could you ask better proof of merit?*

**Mr. Lynch Adds—Read it!**

"It is the *best we have ever seen*—and we have seen and operated almost every type made and used during the past *twelve years*. It has pulled in *forty-six stations* on a *loud speaker* with *two tubes*, using an *indoor antenna*. Its signals have been heard through the air more than a *quarter mile*. *It is not merely the best four-tube receiver, but the best by a very good margin.*"

**Customers Praise it!**

"From Fulton, N. Y., in summer, I received KGO (California) on loud speaker using only two tubes. Also, receive Chicago and nearer stations, using neither aerial nor ground." "The set is all that is claimed." "Selectivity is better than that of my 8-tube super-heterodyne." "I get the distant stations with the same clarity and volume as the local stations!" "It is a wonder in sensitivity, good volume, ease of tuning and tone quality."

Received Europe in recent transatlantic tests. Recently, with it, two-way communication for an hour and a half was held between California and New Zealand—6,000 miles—a record breaker.

Combines principles of Reflex, Neutralization, Tuned Radio Frequency, Regeneration (without blooping), and Push-Pull Amplification. Smooth-working — easily tuned — non-howling — non-squealing—non-reradiative.

The set you have been hoping for!

**This is what you get:**

**Complete Parts**—1 Mahogany finish, piano polish, 7x21 Cabinet, $5.00—1 Hard Rubber, drilled and engraved 7x21 Panel, $4.00—1 6½x20½ Baseboard, $.60—1 set Roberts' Coils, $8.00—2 U. S. Tool Co. 23-plate Variable Condensers, $3.40 each, $6.80—1 Micadon .00025 Grid Condenser, $.35—1 Daven 2-megohm Grid Leak, $.50—1 Micadon .0025 Fixed Condenser, $.40—1 Micadon .005 Fixed Condenser, $.60—1 Neutralizing Condenser, $2.00—3 Tillman 20-ohm Rheostats, $.80 each, $2.40—4 Federal Sockets, $1.00 each, $4.00—1 pair Como Push-Pull Transformers, $12.00—1 Sherma-Tran 5 to 1 Transformer, $4.65—1 Fada-type Inductance Switch, $.25—7 Switch points, $.10—2 Switch stops, $.05—3 Univernier Dials, $1.25 each, $3.75—7 moulded Binding Posts, $1.40—1 Millimeter closed-circuit Jack, $.80—1 Millimeter open-circuit Jack, $.70—2 Eveready type 771 "C" Batteries, $.60 each, $1.20—12 Lugs, $.10—3 lengths varnished Tubing, $.30 each, $.90—12 lengths Bus Bar $.30—1 Instruction Book, with 2 Blueprints, $1.00. **TOTAL, REGULAR PRICE, $61.85.**

**14T98 Complete Parts $48.35**
*Our price, transportation paid*

**Complete Accessories**—2 Eveready 45-volt "B" Batteries, $3.75 each, $7.50—1 Westinghouse 70-ampere-hour "A" Storage Battery, $15.00—1 pair guaranteed Headphones, $4.50—1 Comsco Phone-Plug, $1.00—4 UV-201A Tubes, $16.00—1 complete Antenna Equipment, $4.00. **TOTAL, REGULAR PRICE, $48.00.**

**14T99 Complete Accessories $38.14**
*Our price, transportation paid*

**14T150 Complete Parts and Accessories $84.49**
*Regular Price $100.84. Our price, transportation paid*

If you have any of the items listed, order the remainder and we will charge you on the same basis as though you had ordered all.

**CHOOSE THE WINNER!**

**SEND NO MONEY**

Shipped on approval—within 24 hours. You may examine at your express office before acceptance.

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Ideal set for expert or novice—may be assembled by a boy or anyone by following easy instructions. Said by customers to be "a masterpiece of simplicity." Very popular—no complaints.

Satisfaction guaranteed. Set returnable undamaged after reasonable trial, and money refunded.

Your radio questions answered free.

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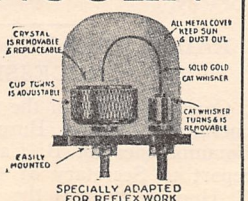
# The "LINCOLN"

Enclosed Fixed Adjustable Detector

Kills your Reflex Troubles

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## INDOOR CAGE ANTENNA

A highly efficient Indoor Antenna System sold on a guarantee of *Reliable Reception.*

Patented. The genuine bears the trade mark Key to the Air.

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Send for circuit diagrams of Single Tube Receiver


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A vital improvement!

MAR-CO SHUR-GRIP jacks—*with hooked terminals*—make set construction easier—short circuits impossible—and leak-proof connections permanent!

Formica insulation thruout—heavily nickeled finish—sterling silver contacts—five types—60 cents to $1.00—and mighty well worth the difference!

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Any MAR-CO plug, with a SHUR-GRIP jack, is ample assurance that all the energy in your set . . actually gets to your speaker!

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OHIO RUBBER
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the curious sounds emitted by his transmitter, which they said sounded like a generator with a flat wheel and interfered with broadcast reception materially. Due to this fact the inventor refused to repeat the transmission of the radio letters, even though Secretary Wilbur, of the Navy and other Government officials were present to observe the apparatus in operation. It was expected that this new means of radio communication would not interfere with broadcasting, but it may be necessary to give Mr. Jenkins a separate wave-length for the continuance of his important experiments.

## GERMAN RADIO PATENTS DESIRED

The Navy Department is being flooded with requests from American radio manufacturers for the use of the German radio patents recently offered on reciprocal licenses. A standard non-exclusive, non-transferable but revocable license has been drawn up and will soon be submitted to applicants with a request for a list of their patents which would become available to the Government. The process of going over the many applications and accompanying lists of patents will require considerable time, officials of the Navy Bureau of Engineering point out, indicating that no licenses will be issued for several weeks. All applications will not be granted; probably only those firms having patents believed of value to the Government will be cross licensed.

Fifty-three applications already listed indicate that many new sets may appear in the near future, involving the famous Schloemilch-Von Bronk reflex hook-up; which is the best known of the German patents.

## RADIO DEVELOPMENTS IN PAST YEAR

Evidence of the rapidity of the growth of radio interest is indicated by the fact that in 1923, one large manufacturer sold $22,465,090 worth of equipment, compared with $11,286,489 in 1922, and $1,468,919 in 1921, according to the Department of Commerce. The cost of radio work of the Department in the past fiscal year was $206,738 compared with $139,200 the preceding year, but more examinations were held and more operators licensed, and nearly a thousand more ships and stations were inspected.

## GOOD RADIO RECEPTION IN EGYPT

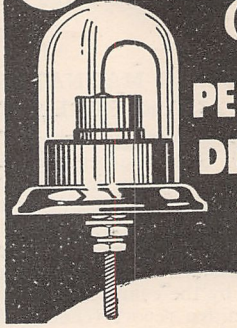
In Egypt radio reception conditions are good. British and other European stations are frequently heard at night, according to U. S. Trade Commissioner May at Alexandria. Only good sets bring in foreign stations, however, due to the low power of broadcasters abroad, but with the opening of the 16-k.w. station at Chelmsford, England, Egyptian listeners hope for better reception. By a recent decree of the Egyptian Government, the issuance of experimental licenses was stopped, but it is believed only temporarily.

## RADIO BROADCAST A PUBLIC NECESSITY

Covering in detail the many phases of the operations of the Bureau of Navigation, Commissioner D. B. Carson in his annual report to Secretary of Commerce, Herbert C. Hoover, stresses the phenomenal growth of radio and the necessity of adequate legislation to provide for future developments in this field.

Although co-operation has enabled the Supervisory Radio Office of the Bureau of Navigation to function under existing laws without serious hardship to anyone, the Commissioner states that a more defined program is desirable.

GREWOL The PERMANENT DETECTOR $1.50



The rigidity and practical design of the Grewol Detector is now combined with the volume and sensitivity of the finest

REFLEX CRYSTAL

procurable. Tests insure the worth of this crystal before the Grewol leaves the factory. The permanent contact eliminates one more tuning device in your Reflex Set.

GREWOL 2 in 1 CRYSTAL

Two surfaces instead of one; double life; double value.

50c. Each

Jobbers! Write For Exclusive Territory Proposition

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GREWOL MFG. CO.
NEWARK, N.J.

$1 ONE DOLLAR BUYS THE ANTENNAPHONE REPLACES THE AERIAL

SAFER than a Troublesome Outdoor Aerial
BETTER than an unsightly Indoor Aerial

The Antennaphone placed under your telephone and connected to the antenna post of your radio receiver (tube or crystal) gives you *sharper tuning*, thereby greatly

Increasing Selectivity and Quality of Reception

Our Money Back Guarantee
The Antennaphone will not interfere with the use of your telephone, and is guaranteed to work perfectly with any receiver (tube or crystal) or your dollar will be refunded.
The Antennaphone, complete with insulated wire. Price..... $1.00

Telephone can be any distance from radio.

AT YOUR DEALER
Or Sent By Mail Upon Receipt of One Dollar

*Correspondence solicited from Radio Jobbers and Dealers*

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90 WEST ST., NEW YORK CITY

Insure your copy reaching you each month. Subscribe to RADIO NEWS — $2.50 a year. Experimenter Publishing Co., 53 Park Pl., N.Y.C.

"It seems probable," he says, "that broadcasting is permanently established as a public necessity and may be considered as indispensable in the average home as the telephone.

"The success achieved in this country has encouraged many other countries to utilize this important means of establishing direct contact with the public."

The question as to who will pay for broadcasting in the opinion of Mr. Carson does not appear to require immediate consideration.

"The public will probably continue to contribute liberally through cost of equipment purchased. At present there does not appear to be a more equitable way of distributing the cost, while, on the other hand, such stations must have considerable advertising value justifying the expense of operation where owners are not benefited through sales of radio apparatus.

"The amateur radio operators are searching for new things in radio and they must be given new fields to explore if their interest is to be held, according to the report. They have succeeded in effecting transcontinental communication and have found it possible to communicate with European stations on short wave-lengths. In view of their past achievement it seems proper that they be given a few narrow working and experimental channels below 100 meters to encourage further development."

## INDIAN UNIVERSITY CURRICULUM INCLUDES WIRELESS TELEGRAPHY

Dacca University, India, now includes in its physics course a preliminary course of instruction in the principles of wireless telegraphy. The University has installed a receiving set and broadcasting is now received from Calcutta. The University is badly handicapped by the lack of sufficient funds with which to employ teachers who are experts in the technique and direct application of the subject. It is hoped, however, that by thoroughly teaching the theoretical portion of the subject and by giving a practical course which will illustrate in general the methods of transmission and reception, that a certain measure of success will be attained.

## FANS WANT MORE WEATHER AND TIME REPORTS

Urban and rural radio fans are beginning to demand daily weather reports and time signals from neighboring broadcast stations, and it is believed that eventually, at least one station in every locality will have to broadcast both time signals and local weather forecasts. Complaints that certain stations do not broadcast either time signals or weather reports, or that no station in a certain locality puts these essential reports on the air, are beginning to come into the Department of Commerce and the Weather Bureau. Neither governmental office has anything to do with the matter put on by private broadcasters, and yet the Government is anxious to serve all fans who desire such data.

Weather reports are broadcast by 20 Naval radio stations, in code, and rebroadcast from 117 private stations, by radiophone, but more may be using local reports.

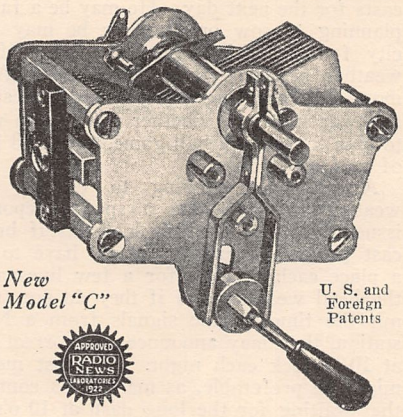
Time signals are sent twice daily from the Naval Observatory at Washington direct through Annapolis, Arlington, Key West and Great Lakes, New Orleans, Eureka, Calif., and North Head, Washington, also broadcast time signals. San Francisco and San Diego transmit Pacific time signals from the Naval Observatory at Mare Island, and these signals are picked up and trans-


For Better Radio

**Hammarlund**

PRECISION

CONDENSER



*New Model "C"*

U. S. and Foreign Patents

APPROVED RADIO NEWS LABORATORIES 1925

AN increased knowledge of radio leads naturally to the use of better parts. But what are better parts? Price should never be the chief consideration in selecting radio equipment. In no other field does quality count for so much. This applies particularly to variable condensers.

The new Model "C" Hammarlund Condenser is the product of 14 years' experience, making precision instruments. It is a masterpiece of engineering—a marvel of efficiency; acclaimed by experts everywhere.

And yet, it is no higher priced than you are asked to pay for inferior instruments.

Insist on Hammarlund Condensers in the radio receiver you purchase. Use only Hammarlunds in the receiver you construct.

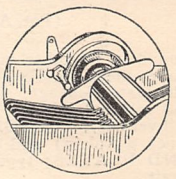
Made in all capacities; plain and vernier. Sold by the better radio dealers.

**9 points of superiority**

1—Soldered brass plates; chemically treated against corrosion; perfect alignment.

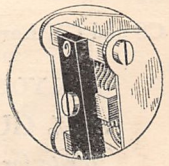
2—Stator plates specially shaped for easy tuning on low waves.

3—Adjustable ball-bearing rotor shaft, grounded through metal end-plates.



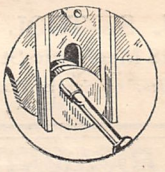
4—Soldered clock-spring pig-tail, with automatic stop.

5—Minimum dielectric; losses too small to measure.



6—Rugged, compact construction; cannot warp.

7—Micrometer vernier; moves all plates; no backlash.



8—Takes any size dial up to 4 in.

9—The product of 14 years' experience, making precision instruments.

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**More Volume—No Distortion**

Correct spacing of first grade silicon steel leaves in core carries away high flux densities which causes other transformers to distort reception. Ratio 4.25 to 1. Equally efficient in all stages. The Flint is the best looking A.F.T. made, and the finest built. $3.00 each. If your dealer can't supply you, order direct. Money back guarantee. Dealers, write us.

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Special Sizes to Order at $2.50 each

When better resistances are made they will bear the Crescent label. Dealers write for discount.

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**YOUR $100**

Or whatever you paid for your set, may be wasted due to leaks thru loose connections. ALLEN Flux and Soder is the remedy. Allen Sodering Paste 10c, or Liquid 15c, with valuable booklet on Radio Sodering.

L. B. ALLEN CO.

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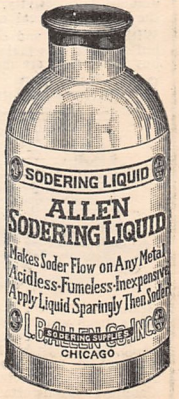


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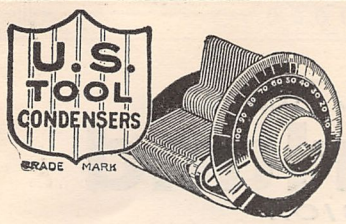


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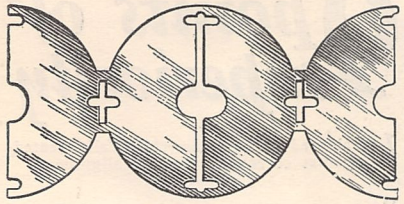

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**CS and CV Low Price Types always in stock.**

**ASK YOUR DEALER!**

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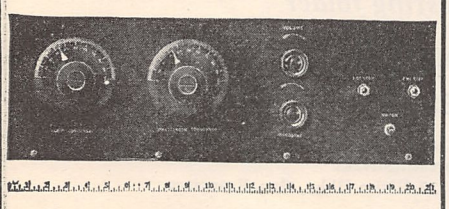
Mfrs. of Special Tools, Dies, Jigs, Automatic Machinery and Sub Presses.



**BRANSTON RADIO**

## Make 7 Dry Battery Tubes do the Work of 10 in Super Heterodyne Set You Can Build



**Panel Size 7 x 21 Inches — Only 2 Controls.**

THIS set was built using the Branston Kit shown below. It is a strictly loop set of coast-to-coast range. It has remarkably fine tonal qualities, great volume, wonderful selectivity. It amplifies distant stations to the volume of local ones.

With our clear and complete instructions you can easily build a set to equal this,—a better set than you could buy for a lot more money.

**8 MATCHED TRANSFORMERS $35**

Branston Kit No. R-199. 3-stage long wave R.F. Transformer $13.50, Twin A.F.'s, $8.00, Single Stage long wave R.F. $4.50, Long Wave Tuned R.F. $4.50, Special Tuned Coupling Transformer $4.50, Short Wave R.F. $4.50. (Sold separately if desired). All matched to same resonant frequency, and given operation test.

**Send for Blue-prints and Catalog**

Send 25c in coin or stamps for complete blue prints and layout covering Super Heterodyne, Radio Frequency and Honeycomb Coil Circuits also complete catalog of Branston Quality Radio products.

Your dealer has Branston Kits or can get them for you.

**CHAS. A. BRANSTON Inc.**
**817 Main Street**
**Buffalo, N. Y.**

Manufacturers of Branston Violet Ray High Frequency Generators.

**In Canada—**
**Chas. A. Branston, Ltd. Toronto, Ont.**


mitted by Cavite, P. I. In the Canal Zone both Balboa and Colon transmit time signals by relay, picking up either Arlington or Annapolis.

It is seen that time signals in code, that is by the second-beat system, are made available in practically all parts of the country and most of the Insular Possessions, so that private broadcasters can relay or retransmit them if they so desire.

The radio fan is beginning to put his receiving set to a practical use and wants to know the correct time and the weather forecasts for the next day. He may be a farmer planning to sow or reap, or he may be a city fan preparing for an outing if the weather promises to be propitious. Again most fans are interested in outdoor sports and want to know whether it is worth while to plan to attend a ball game, get in 18 holes of golf or go fishing.

Aviators are coming to depend upon weather forecasts and a special report is issued for their use. It looks as if broadcast program managers would have to find a place each evening for a few lines about the local weather, and if they do not transmit the time marine signals from a Naval station, they may announce the correct time at 10 o'clock each night. The last method might be preferable, as many fans complain that waiting for the long dash at 10 o'clock is a terrible bore, and requires five minutes, whereas a simple "stand by" signal a minute or two before the hour with the announcement "10 o'clock," giving the local time zone, would be sufficient. At sea where the exact checking of chronometers is necessary, the dash method is of course essential.

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## PORTO RICAN BROADCASTER HEARD IN CZECHOSLOVAKIA

Station WKAQ, operated by the Radio Corporation of Porto Rico, a subsidiary of the International Telephone & Telegraph Corporation has been conducting a series of tests with the "Radio Iberica" in Spain. Not only has the reception of the station been very clear in Spain, but also in more distant parts of Europe, as the following letter attests:

Manager,
Radio Station,
San Juan, Porto Rico.
Dear Sir:

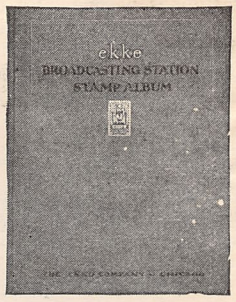
My attention having been drawn to the experiments made between you and the "Radio Iberica," Madrid, I attempted to pick up your signals today and succeeded most satisfactorily.

I have two stages of radio frequency, detector and two stages of audio frequency, which apparatus I have connected to a two-wire antenna, 83 feet long. The set is one equipped only for the reception of European stations, and today for the first time I picked up an overseas station.

From 2:25 to 2:40 a. m. (Greenwich time) I picked up, with few interruptions, piano concerts and speeches; at 2:43 an orchestral concert, followed by an address in Spanish; from 2:51 to 2:56 I lost this station, but again picked it up at 2:56, when orchestral selections came through clearly; the orchestra was followed by more speeches and music until 3:23. At 3:25 I changed the wave-length and picked up what I presumed was a confirmation of the experiment being made between Madrid and your station in Porto Rico. Notwithstanding atmospheric interferences your program numbers were clear and pleasing.

I believe this information will interest you, as Bohm-Leipa in Czechoslovakia is about 1,240 miles from Madrid, making the distance still greater than from Porto Rico to Madrid.

I should appreciate it, if you would send me the time and dates when you regularly


# Have you your EKKO Broadcasting Station Stamp Album?

Here's what every radio fan has wanted—a convenient, permanent and authentic means of recording all the stations you hear over your set. The Ekko Album contains spaces for a beautifully engraved stamp from each of more than 650 stations. These stamps are verified and prove your reception of the station.

**Proof of Reception** cards are furnished with the album. You send the card to the station, together with ten cents, to cover cost of verification, giving facts which prove to the station you have heard their broadcasting. In return the station sends you their verified stamp as evidence of actual reception. The stamps are beautifully engraved in different colors and there is an individual stamp for every station showing the station call letters.

The album is 9½ x 11 inches, handsomely bound in a two color cover. It contains 96 pages, with spaces for stamps of all recognized stations in the U. S. and Canada, arranged alphabetically by states and call letters. It also contains an alphabetical list of the official names and other interesting features of stations, as well as a convenient log.

See your dealer today and get a copy of the Ekko Album and **start a collection of these stamps.** You will find this a new and fascinating method of verifying the stations you hear. If your dealer cannot supply you, sent direct on receipt of price. Money back if not satisfied.

**Price $1.75**
(Price in Canada $2.50)

## The EKKO Company
**111 W. Monroe Street**
**CHICAGO**



## Get those Tantalizing Stations WITH E-Z-TOON (EASY TUNE) RADIO DIALS

Stations close together and hard to get are brought in easily with E-Z-TOON Radio Dials. The larger dial is for coarse tuning (finding the stations) and the smaller dial is for fine tuning (tuning stations clear). The ratio of the larger dial to the inner dial is 50 to 1. E-Z-TOON dials give that fine vernier adjustment that "Radio fans" have been longing for. Zero on either Right or Left.

There are no cogs, gears, back-lash or lost motion. E-Z-TOON Dials require only a screw driver to install. Take off old dials—slip on E-Z-TOON and tighten set screw. We also furnish small dials to match for Rheostats, Switches, etc.

**3" Dials .....$2.00**
**4" Dials ..... 2.25**
**2" Rheostat Dials ..... .40**

**Order from your Dealer. If he can't supply you, write**

**E - Z - TOON RADIO CO.**
3234 W. Washington St. Indianapolis



## Dealers Write For Money-Saving Catalog

We are authorized distributors of Freshman Masterpieces, Fada, Timmons, Kellogg, Frost, Eveready and a hundred other nationally advertised radio manufacturers.

**If It's Radio We Have It.**

**GERSHON ELECTRIC CO.**
1817 Walnut St. Kansas City Mo.

broadcast, so that I may pick up your programs.

Should you wish to undertake experiments here, I shall be at your service at any time with my receiving apparatus, and I am ready to improve my outfit in order that I may pick up other American stations.

Very truly yours,
(Signed) FRITZ SCHULLER,
Bohm, Leipa,
Czecho Slovakia.

## MORE MONEY FOR RADIO

The Department of Commerce will probably be authorized to expend $220,525 in the fiscal year 1926, for the enforcement of radio laws, including station inspection and the licensing of stations and operators, if the figures submitted by the Bureau of the Budget are not reduced in Congress. The Budget submitted by the President on December 1 carried $15,287 more than the amount allotted for radio supervision last year, and may permit the employment of a few extra clerks and field inspectors.

Increased personnel is necessary, due to additional work in connection with the policing of the air.

## NAVAL RADIO SAVES GOVERNMENT ALMOST A MILLION

The Naval Communication service which is virtually all radio, is a big factor in governmental economies these days. Adding what it actually earns by handling commercial accounts and what it saves on transmitting official messages, the total approaches a million dollars a year.

During the past fiscal year the Naval stations collected $315,000 for commercial messages sent, compared with earnings of $262,738 in 1923 and $1,095,842 in 1920. Naturally the Navy does not compete with commercial radio stations, only operating where and when commercial stations are not available or able to handle traffic.

An estimate of the saving to the Government in 1924 on official messages sent by radio, compared with the cost if the messages had been sent at Government rates by commercial stations, approximates a half million dollars. The check on messages handled and on rates is not comparable to commercial systems, however, due to lack of Naval necessity and personnel. Of course the saving is "on paper." Actual official traffic handled for the Navy and other Governmental departments in the past fiscal year, nevertheless, shows a grand total of over 90,000,000 words; 17,000,000 words were sent and received by the Alaskan division, the great volume being due partly to the failure of the government cable during that time. The Washington office, known as Radio Central, handled 12,000,000 words during the same time, other districts making up the grand total. Messages sent and received, between two stations are counted twice, however, as each station counts the traffic handled.

Primarily the Naval Communication Service is maintained to provide a means of communication between the seat of Government and the various naval units, as well as between these units, both in time of peace and war. The handling of other government business is incidental, and the transmission of commercial traffic is only under specific conditions defined by law. Today the Naval radio net includes 13 primary stations, with ranges between 2,500 and 5,000 miles; 23 intermediate stations varying in range from 1,000 to 2,000 miles; 72 coastal stations reaching about 1,000 miles, and 55 radio compass stations. Besides these, there is a radio station on every ship and aircraft, and three experimental stations such as the Naval Research Laboratory at Bellevue. Besides stations in all our Insular Posses-

CELESTO
"SHADOW BLACK"

THIS is the most beautiful radio panel ever developed! All the unsurpassed insulating qualities of genuine Hard Rubber—and striking beauty besides—because CELESTO Panels are genuine Hard Rubber.

SHADOW BLACK Celesto Panels cannot scratch; they cannot show finger marks.

No illustration can convey to you the actual beauty of SHADOW BLACK Celesto Panels. Go to your dealer today and inspect them! And remember that he stocks a complete line of the standard CELESTO Panels.

CELESTO Panels are also made in Plain Black and Mahogany.

CELESTO RUBBER CO.
68-74 South St., Boston

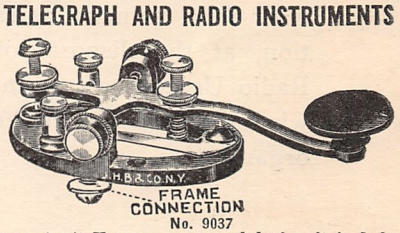
PERSONAL STATIONERY
200 SHEETS and 100 ENVELOPES $1.00
Printed with your Name and Address

Clear, white bond paper, with envelopes to match. Your name and address printed in beautiful, rich blue ink, on both paper and envelopes, and sent to you postpaid for only $1.00. (West of Mississippi river and outside of U. S. $1.10.) If inconvenient to send the money, we will ship C. O. D. Money returned if you are not more than satisfied. Order today. Write name and address plainly.

AGENTS MAKE BIG MONEY taking orders for us. Write us today for our agent's proposition.

ELITE STATIONARY COMPANY
7056 Main Street Smethport, Pa.

TELEGRAPH AND RADIO INSTRUMENTS




No. 9037

Open circuit Keys are recommended when it is desired to have two way communication between points without the use of closed circuit batteries.

Other types carried in stock.

No. 9037 Legless Key, Polished Brass Body.....$6.00
No. 9035 Leg Key, Polished Brass Body..... 5.60

Send stamps for Telegraph Manual 43-R
SPECIAL PRICE TO DEALERS
J. H. BUNNELL & CO. 32 Park Place, N. Y.

Insure your copy reaching you each month. Subscribe to Radio News—$2.50 a year.
Experimenter Publishing Co., 53 Park Place, N. Y. C.

# The Radio Union

## The Radio Purchaser and Radio Dealer in an Association for Mutual Benefit

Under the auspices of "Radio News," the World's Leading Radio Magazine, an association has been formed, having for its object, the bringing together of consumer and merchant, in a way that will permit every radio owner to save money on his purchases.

The Radio Union is a mutual benefit association of radio stores and radio enthusiasts. Every member store agrees to give a discount on every sale made to individual members. The member stores will benefit because our members will patronize those stores at which they obtain a discount on their purchases—the individual members benefit because they will save money on every radio purchase, and eventually on purchases made for all other necessities, such as groceries, clothing, jewelry, automobile supplies, drugs, furniture, etc., etc.

Every live radio dealer has been invited to join The Radio Union, and contracts stipulating the discounts that will be allowed on member's purchases are pouring in from every city in this country. Eventually invitations will be sent to stores selling all classes of merchandise, in your town, so that very shortly you can make large savings, not only on your radio purchases, but on everything else you or your family buy. The list of membership stores will be sent to every enrolled member.

The dues for membership will be $5.00, entitling you to life membership, guaranteeing you against any further dues or assessments, and entitling you to a discount on every purchase you or any of your immediate family make in a membership store.

We want 50,000 Charter members. To these first we offer a membership at only $2.00—a saving of $3.00. Remember this is the only cost—there are no dues or assessments that you will ever have to pay. All you must do to obtain your discounts from member stores is to send us once a month, or oftener if you wish, the bills or sales slips for purchases made from member stores. These bills will be verified by the stores from which the goods were purchased and they will remit the discounts to us. These savings we forward to you after deducting a small charge for our operating expenses and overhead.

You have everything to gain by becoming a member in this Radio Union and can save $3.00 by joining now as a charter member. A single purchase will more than make up the small fee of $2.00 which you pay to join the Association.

## DO IT TODAY

*Remember the regular Membership fee will be* $5.00 *hereafter.*

*Fill out the application blank, and mail it today with your remittance.*

## Officers and Directors

The personnel of the Officers and Directors of The Radio Union is quite sufficient to guarantee the success of the new association. The Officers and Directors are Messrs. Hugo and Sidney Gernsback and Mr. R. W. DeMott, the owners of the Experimenter Publishing Company, the publishers of Radio News, Science & Invention, The Experimenter, and Motor Camper & Tourist. These great magazines, with their tremendous circulation, at the disposal of The Radio Union, assures an overwhelming success to the new organization.

**APPLICATION FOR MEMBERSHIP** R-32

**THE RADIO UNION, INC.**, 53 Park Place, New York City, N. Y.

Gentlemen—Enclosed you will find Two Dollars ($2.00) for charter Membership fee in **The Radio Union, Inc.**

I understand this payment entitles me to a **Life Membership** and to a discount on every purchase I make in a membership store, list of which you will forward.

NAME ..... STREET .....

TOWN..... STATE.....

sions, the Navy also operates a station in Peking, China; Managua, Nicaragua, Port Au Prince, Haiti, where Marine Corps detachments are located.

Both the Naval Bureau of Engineering and the Naval Communication service have extended congratulations to the Marine Corps personnel, which operates the Naval Radio Station at Pekin, China, one of the most isolated stations in the service. Over 500,000 words of traffic were handled without interruption last year.

## FANS IN INDIA PAY FOR THEIR RADIO PROGRAMS

Those who complain of broadcast interference in the United States should be thankful that there are numerous stations and that listening-in is free.

Radio fans in India will have to pay for their broadcast programs, as is done in England, but will be permitted to purchase such sets as they please, if the recommendations of the Radio Club of Bengal are accepted. The formation of a public broadcast company similar to the British Broadcasting Co., to handle radio broadcasting, under the supervision of a provincial council to watch local interest, has been suggested. No monopoly as far as the handling of receiving sets is concerned will be permitted, the public being left free to build or buy any set. Imports of wireless apparatus is unrestricted, but a duty of 7½ per cent. on complete sets and 5 per cent. on accessories will probably be charged. All persons desiring to receive broadcast programs will have to take out licenses at a cost of 10 rupees per annum, the major portion of which with 80 per cent. of the duty returns will go to the broadcasters as a subsidy.

## NEW ZEALAND RADIO DEALERS TO BE LICENSED

A bill providing for the licensing of radio dealers and the application of a portion of the fees thus collected to the assistance of broadcasting agencies has been introduced in the New Zealand Senate. Arrangements for the formation of a company to operate 400 and 500 watt stations, in important centers, awaits legislation.

## BATTERY SWITCH ARRANGEMENT FOR TESTING RADIO SETS

By R. H. LANGLEY*

In making comparison tests between radio sets it is advantageous to have a double throw switch by which either of two sets may be quickly connected to the antenna and ground and to the batteries. The arrangement of a switch to do this is complicated by the fact that various manufacturers use different methods of connection between the "A," "B" and "C" batteries.

Considering only two plate voltages and one bias voltage, a nine pole double throw switch would seem to be required in order to prevent short circuit of the batteries due to differences in inter-connection in the sets. These nine points would be:
Antenna 90 45 —B +A —A +C —C Ground

An investigation shows that a six pole switch can be made to do all the work, because the 90 volt, the 45 volt, and the —C are all insulated in any receiver. These three points can therefore be omitted from the switch and terminals can be provided for them to which all the sets may be permanently connected as indicated on the instruction card. The switch will then carry:
Antenna —B +A —A +C Ground.

This arrangement has the further decided advantage that terminals can be provided for various "B" and "C" battery voltages and the sets under test can be connected directly

*Radio Engineer, General Electric Co.


*New Improved*

**AMPL-TONE**

GUARANTEED

**Radio Headset**

**Full 2200 Ohms**

**New Price $5.00**

For three years these Headsets have been tried, tested and proven their value. There are thousands in use to-day, still giving perfect satisfaction, having sold on their merits. Our production has allowed us to reduce the price.

Unexcelled for crystal sets and capable of great distance reception with tube sets.

Your set, large or small, deserves a **Real Good Headset** for results.

Many new improvements so ask your dealer for the **new improved Ampl-Tone Headset** or write us direct.

Manufactured by

**The Union Fabric Company**

DERBY, CONNECTICUT

**KEYSTONE VACUUM TUBES**

ALL TYPES $4.

GUARANTEED

*Unequaled for Clarity of Tone and Long Life.*

KEYSTONE ELECTRIC & RADIO COMPANY
110-116 Nassau St. New York, N. Y.

**DEALERS!**

Write For Discounts on

BURNS FEDERAL
BREMER-TULLY FROST
ACCURATUNE DUBILIER
DAVEN SHAMROCK

*and Other Standard Lines*

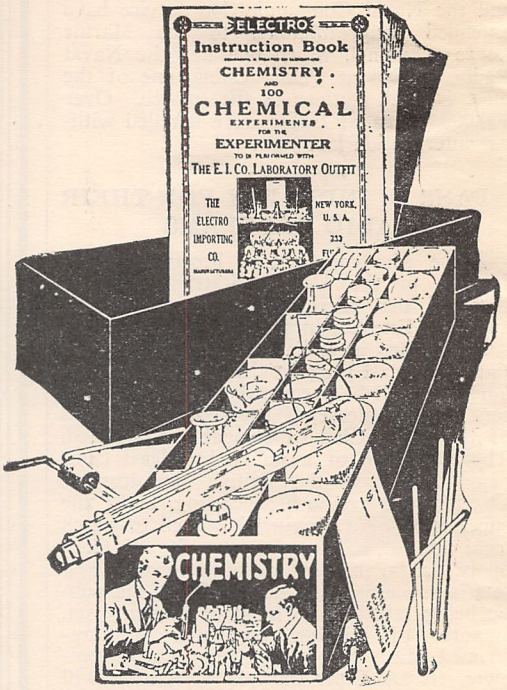
**PRAIRIE STATE RADIO CO.**

39 W. Adams St., Chicago, Ill.

Insure your copy reaching you each month. Subscribe to Radio News—$2.50 a year.
Experimenter Publishing Co., 53 Park Place, N. Y. C.

# A Chemistry Laboratory for $7.00

Think of it, fellows! Here is a *real* chemistry outfit with regular chemical apparatus that performs those fascinating, actual chemical experiments. This outfit is not a toy, put up merely to amuse, but a practical laboratory set, with all the chemicals, apparata and reagents necessary to perform real work and to teach the beginner all the secrets of inorganic chemistry.




## *DESCRIPTION OF THE OUTFIT*

The outfit consists of 44 Chemicals and Reagents all C. P. put up in appropriate wooden boxes, glass bottles, and hermetically closed jars. The acids are put up in glass bottles with ground-in glass stoppers, and there is a sufficient quantity of chemicals supplied (mostly one to two ounces) to make dozens of experiments with each.

The apparatus furnished are all of the best obtainable make and of standard laboratory size and shape.

*The Instruction Book is a real Chemistry Course for the Beginner.* Some of the Contents are: *Division of Matter*: This is a Treatise on Elementary Chemistry and deals with the theory of the Elements, Molecules and Atoms, etc. *Chemical Nomenclature*: This explains in simple language the derivation of the chemical names of the elements and their compounds. There is a chapter on *Laboratory Operations; Glass Working; First Aid; Fire Extinguishers; Experimenters' Aphorisms,* etc.

A good part of the book is devoted to Weights and Measures. The Metric System, The English System and the U. S. System are fully explained.

The following tables are furnished: Symbols and Atomic Weights of the Elements; Measures of Weights, Volume, Capacity and Length; per cent solutions; Conversion of Measure expressed in parts; poisons and their antidotes; technical and common name of chemical substances; formulas for cleaning various substances, etc., etc.

*Among the 100 Experiments are:*

How to make chemical tricks; How to make invisible and magic inks; How to test flour; How to test soil; How to make chlorine gas and smoke (German War Gas); How to bleach cloth and flowers; How to produce Oxygen and Hydrogen; How to make chemical colors; How to test Acids and Alkalies and hundreds of interesting hints and formulas.

**Complete, $7.00 Sh. Wght., 10 lbs. (Shipped by Express only)**

***(We guarantee shipment within 24 hours after your order is received)***

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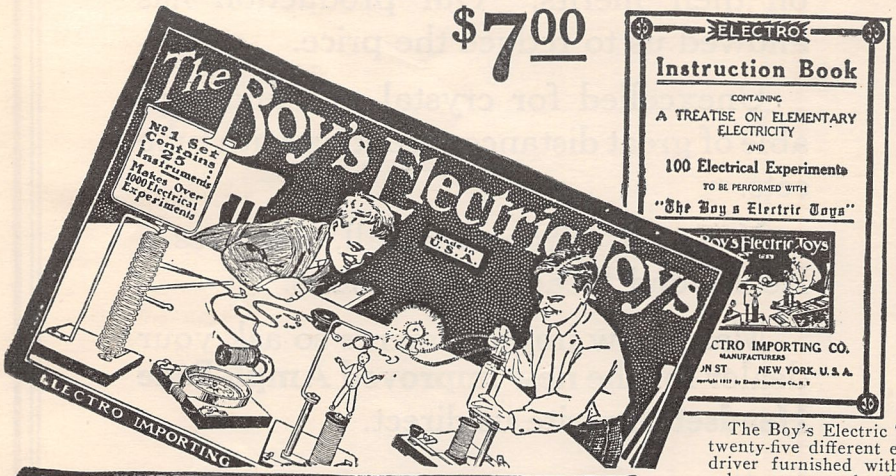
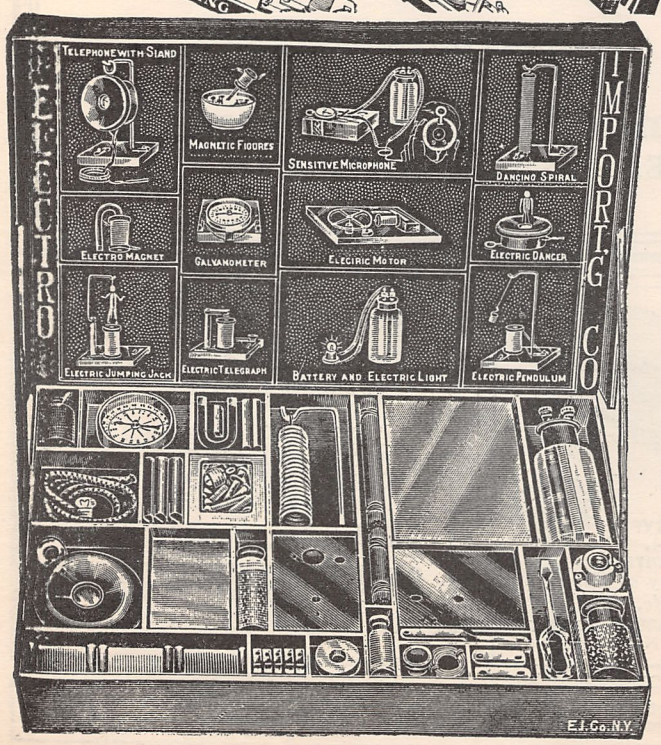
**$7.00**




## Every Fellow Wants the BOY'S ELECTRIC TOYS

The Boy's Electric Toys contains: Enough material to make and complete over twenty-five different electrical apparatus without any other tools except a screw-driver furnished with the outfit. Student's chromic plunge battery, compass-galvanometer, solenoid, telephone receiver, electric lamp, etc. Enough various parts, wire, etc., are furnished to make the following apparatus:

Electromagnet, electric cannon, magnetic pictures, dancing spiral, electric hammer, galvanometer, voltmeter, hook for telephone receiver, condenser, sensitive microphone, short distance wireless telephone, test storage battery, shocking coil, complete telegraph set, electric riveting machine, electric buzzer, dancing fishes, singing telephones, mysterious dancing man, electric jumping jack, magnetic geometric figures, rheostat, erratic pendulum, electric butterfly, thermo-electric motor, visual telegraph, etc., etc.

With the instruction book we furnish one hundred experiments that can be made with this outfit, nearly all of these being illustrated with superb illustrations. No other materials, goods or supplies are necessary.

*The outfit contains 114 separate pieces of material and 24 pieces of finished articles ready to use at once.*

The size over all of the outfit is 14 x 9 x 2¾. Shipping weight 8 pounds.

"The Boy's Electric Toys" outfit as described, $7.00. Immediate shipment.

## SEND NO MONEY

We have so much confidence in these sets that we desire to ship either one to you by express C.O.D. with the privilege of inspection. In other words, we ship on approval. It does not cost you one cent to take a good look at whichever outfit you want, and see if it comes up to your expectations. If it does, pay the express man $7.00, plus express charges. If not, you need not accept it, and we will pay the return charges as well.

**ELECTRO IMPORTING CO., 233 Fulton St., NewYork City**

ELECTRO IMPORTING CO.,
233 Fulton St., New York

Please send me by express THE CHEMICAL LABORATORY. If I don't like it I need not accept it. If I want it I only pay $7.00 plus the few cents express charge.

.....

.....

.....

RN—2-25

ELECTRO IMPORTING CO.,
233 Fulton St., New York

Please send me by express THE BOY'S ELECTRIC TOYS. If I don't like it I need not accept it. If I want it I only pay $7.00 plus the few cents express charge.

.....

.....

.....

RN—2-25

to these terminals. For example, terminals can be provided for 22, 45, 90 and 135 volts "B" battery and for 4½ and 9 volts "C" battery. Inasmuch as opening the switch disconnects the —B and the +C, and disconnects the "A" battery entirely, from all sets, there is no possibility of a short circuit, due to differences in interconnections.

### FIRESIDE SEATS AT THE ETHERIAL OPERA

Station WHB, in Kansas City, is attempting to solve the difficult problem of who will pay for broadcasting, by selling "listening in" seats to its invisible audience. Seats run from $1 for general admission to $10 for boxes, and all fans within range are to be supplied with programs as in regular theatres. Just how the sale of seats in this etherial theatre are going is not known, but the idea is believed a sound one, as most fans have a favorite station to the support of which they are willing to contribute.

### ADDITIONAL RADIO FOG SIGNAL SERVICE FOR NANTUCKET SHOALS LIGHT VESSEL, MASS.

The radio fog signal on the Nantucket Shoals Light Vessel will be operated every day and night during the second 15 minutes of each hour in clear weather for experimental and test purposes for a period of six months, which began about October 29, 1924. During foggy weather the radio fog signal will be operated continuously except during daily listening-in periods from 10 to 10.15 a. m. and from 4 to 4.15 p. m., seventy-fifth meridian time. Vessels are requested to forward reports to the Commissioner of Lighthouses, Washington, D. C., or to the superintendent of lighthouses, Boston, Mass., as to the effectiveness of this additional service.

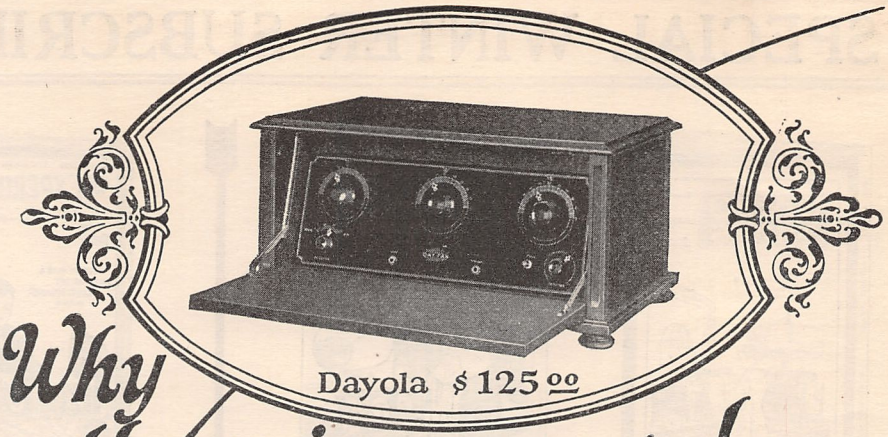
### SHIP WAVES REASSIGNED

Department of Commerce Radio Supervisors have been advised by the Commissioner of Navigation that ships may no longer operate on the 300 and 450 meter wave-lengths, in accordance with the recommendations of the Third National Radio Conference. The Marine Service, however, is permitted to send and receive radio signals on some new short waves assigned mobile stations, between 109 and 120 meters. The old 600 meter wave is now to be used for calling and distress signals only. Traffic may be conducted on 706 and 875 meters, radio compass service operates on 800 and coast radio beacons on 1,000 meters. I.C.W. and C.W. and spark transmitters may operate on 600, 706, 800 and 875 meters, the new regulations state. This aids considerably in clearing the broadcast bands of interference from ships.

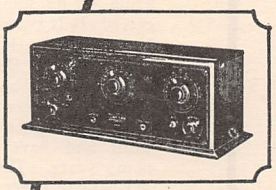
Owners and operators of ships sailing under the American flag are reported as taking steps to place in immediate effect the recommendations of the Radio Conference with reference to improving communication at sea. Merchant Marine skippers, including captains of all the vessels of the U. S. Fleet Corporation, are readjusting their transmitters to handle all traffic and "distress messages" on the new wave-lengths assigned.

Efforts are also being made to keep decrement to a minimum. The law sets the permitted decrement at 0.2, but the recent conference recommended that it be reduced to 0.114, and before six months it is hoped by the Merchant Marine that it may be reduced further to 0.1. This action will tend to eliminate interference ashore as well as at sea and reduce complaints of broadcast reception along the coasts and especially at American ports.

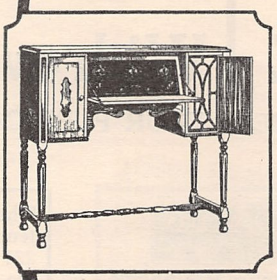
Ship owners have also made an earnest


Why there is more value in DAY-FAN Radio



OEM-7 $98.00



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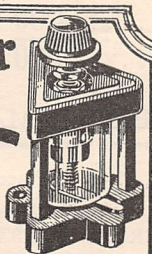

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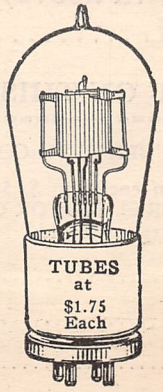


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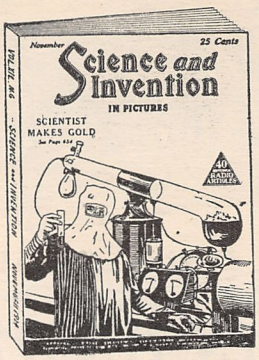


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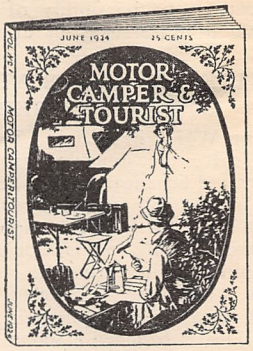


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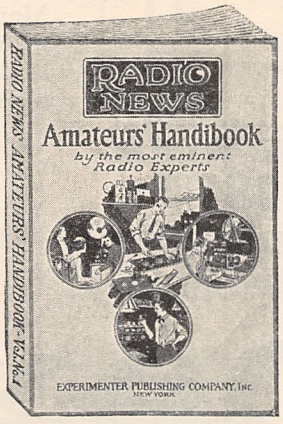


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effort to bring spark set emissions to a point of favorable comparison with I.C.W. transmitters. This has been accomplished partly by the reduction of the decrement and the employment of a single-wire ship's antenna. Many ship owners cannot afford to install tube sets, but they are hopeful of improving their spark sets so as to eliminate the constant complaints of fans, some of whom fail to realize that radio transmission is the only method of communication available between ships and shore stations. Although ships were first to accept radio as a practical means of communication, a method which soon became compulsory by law, they are now blamed for using it at all by some intolerant radio fans who are convinced that broadcasting is the only essential form of radio communication.

## CORRECTION

On page 1148 of the January issue of RADIO NEWS, it was stated in the caption accompanying the photograph of the well-known announcer, George D. Hay, that "he was stationed at WAHG, the new Grebe station, at Richmond Hill, New York." We wish to correct this error. Mr. Hay is still announcer at station WLS, Sears Roebuck Co. Broadcast Station, Chicago.

## AMERICANIZATION BY RADIO

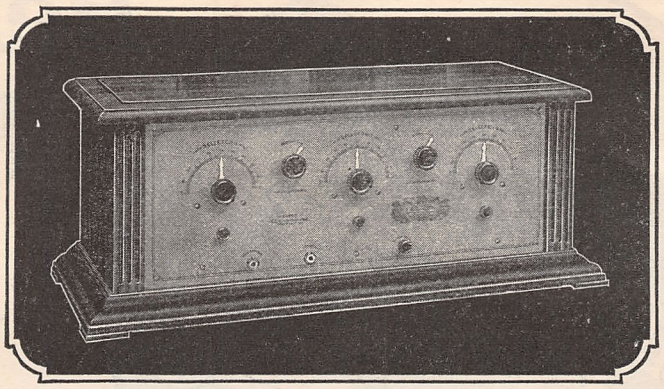
By CARL H. BUTMAN

The United States will probably soon employ broadcasting in an effort to Americanize its six million adult aliens. The co-operation of about 20 broadcast stations will be sought by either the Federal Council of Citizenship Training or the Bureau of Naturalization, if the suggestions of the writer are taken as seriously as they appeared to be when they were made.

Although radio broadcasting has been found of inestimable value in practically every walk of life, from politics to the search for lost persons, curiously enough, its adaptation to the education and ultimate naturalization of aliens seems never to have occurred to either the broadcasters or the Government bureaus concerned.

A trip through the east side of New York will convince the skeptical that the scene is already set; that is, facilities for the reception of Americanization programs via the ether by at least half of our alien population exist. Nine out of ten tenement houses where dwell foreigners of every type and class are bedecked with dozens of aerials, and so are many individual homes of alien families, most of whom listen in each night for whatever they may hear. The physical makeup of many of our immigrants includes a love for the musical. It is inbred, and as aerial music is free—at the price of a simple receiver—thousands of them listen in. This is also true in cities which are manufacturing centers, where the newcomers settle down. Naturally, they hear little but English spoken on the air, but nothing like instruction is available, or if it is, they do not know it, nor are they informed how to become citizens.

The Bureau of Naturalization, of the Labor Department, which in co-operation with state and county educational institutions makes strenuous efforts to make known its requirements for naturalization, states that last year 425,540 adult aliens applied for citizenship, filing first papers, and that 149,000 were admitted to citizenship. This number, large as it seems, scarcely scratches the surface, as the total number of resident aliens is estimated at six million. There are, therefore, over five and a half millions who are either unadvised as to the procedure in becoming citizens or have not the proper incentive. It is to reach these prospective citizens that radio broadcast stations located in

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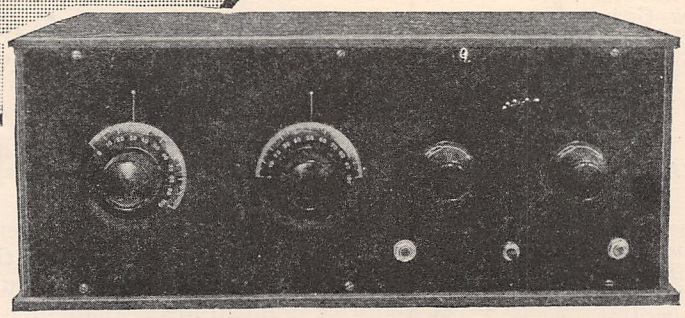
## HOW TO MAKE A Low Loss RECEIVER



Wiring diagram shows each circuit in a different color

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## Build Your Own "LOW LOSS" Receiver with this New Pattern

Last year everyone was building Power sets, larger and larger grew the already complicated receivers. When more volume or greater distance was desired more tubes were added. Everyone overlooked that vital factor of high efficiency, namely LOW LOSS. It is the high efficiency of the LOW LOSS Receiver that gets the distance, produces clarity and insures ample volume.

Consrad has just published a New Pattern. A standard, high efficiency LOW LOSS receiver that embodies every notable modern advance along that line. This new pattern is the most complete, most practical and most easily understood pattern ever published. It contains two full size blueprints, size 14 by 19 inches, giving wiring diagram and panel layout and a complete 16 page instruction booklet. The entire pattern is enclosed in a heavy, two color manila folder size 9 x 12 inches.

The blueprint of the wiring diagram incorporates a unique new idea of inestimable value to the user. The wiring of each circuit is printed in a different color, thus: GREEN for the aerial circuit, YELLOW for the low potential or ground, RED for plate and "B" Battery and WHITE for the grid circuit.

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the centers where they dwell will be asked to aid the Federal Council of Citizenship Training, appointed by the late President Harding. Dr. J. J. Taggert, of the Bureau of Education, is chairman of this body which is composed of representatives of twelve Governmental bureaus, and which co-operates with committees in a large number of states.

Officials of the Government point out that informative matter broadcast would aid the council materially if worked out on a constructive program. Such a program should include the instruction of the alien in the national language and the elemental principles of government, in both of which subjects he must be schooled before he can become a citizen. Citizenship courses were begun in 1915. As there are over 3,500 community schools where adults of foreign birth are now being taught, local co-operation would readily be furnished such stations as undertook the broadcasting of citizenship training. If the scheme is established one of the lectures broadcast would cover the requirements of citizenship, explaining that a five-year residence is necessary, and that two years prior to admission an application known as a first paper or declaratoin must be filed.

The very foundation of our future welfare and unity depends to a large extent upon the education and amalgamation of our adopted sons, who are entitled to every privilege accorded a citizen, except eligibility as president and vice-president. Department officials point out that two secretaries of Labor were once immigrants themselves; the first Secretary, Wilson, was a Scotchman, while the present Secretary, James Davis, was born a Welshman.

Field offices of the Bureau of Naturalization are located in practically every large city where aliens are numerous, and it is believed that broadcasting from these centers would be beneficial. School teachers report to the Government that in no work undertaken have they secured the response and results that they achieve in adult instruction among foreigners. The richest return to them, they say, is the deep appreciation of their students who learn to speak English. This field is undoubtedly an opportunity no progressive broadcast station owner can afford to neglect.

---

### OVER SIX HUNDRED STATIONS QUIT IN THREE YEARS

Out of 1,180 broadcast stations, which have been on the air since September, 1921, a little over three years ago, only 550 are active today. This means that 630 stations have ceased to broadcast, due to lack of operating funds, lack of returns either tangible or intangible or lack of interest. It would seem that they did not pay—nearly a hundred more than exist today have quit.

It is perhaps fortunate for the fans that they all did not stop at the same time, else the nation's popular indoor sport would have ceased quicker than it began, but the changes in the broadcasting lists have been gradual. A few stopped operation and a few more came on the air each month. There are some fans in the radio audience today who claim that there are far too many stations as it is. They seem glad to see some quit, believing that the best will survive, and that about a hundred good, high-powered stations would be the ideal number. In which event, they point out each broadcaster could have a separate wave-length and reception would be nearly perfect.

Practically all of the original 28 stations which started late in 1921 remained on the air for a year, and some of them of course exist today. In 1922, 642 new stations opened and 94 quit operation; in 1923, 249 started up and 298 ceased transmitting, while


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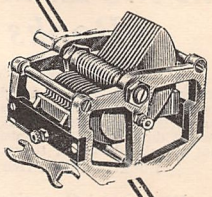

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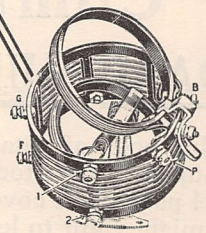
Radio 2WR, Arthur G. Wester, Assistant Division Manager of Hudson Division, American Radio Relay League, wrote us as follows: "Having obtained one of your new Short Wave tuners, I would like to mention results obtained. New Zealand 4AA on 80 meters was copied on November 13 steadily from 6:16 to 6:39 A. M., E. S. T. The estimated distance is 9600 miles. Mexican BX was worked from this station on November 15 and not one word was missed. Numerous other stations from all over the United States have been copied, including 6CTO, 6BNY, 6AME, 6ADT, 6BDT."

Radio 9ZA, Chicago, Illinois, received English, French and Mexican stations, both code and voice, in testing with one of our first stock Short Wave Low Loss Tuners.



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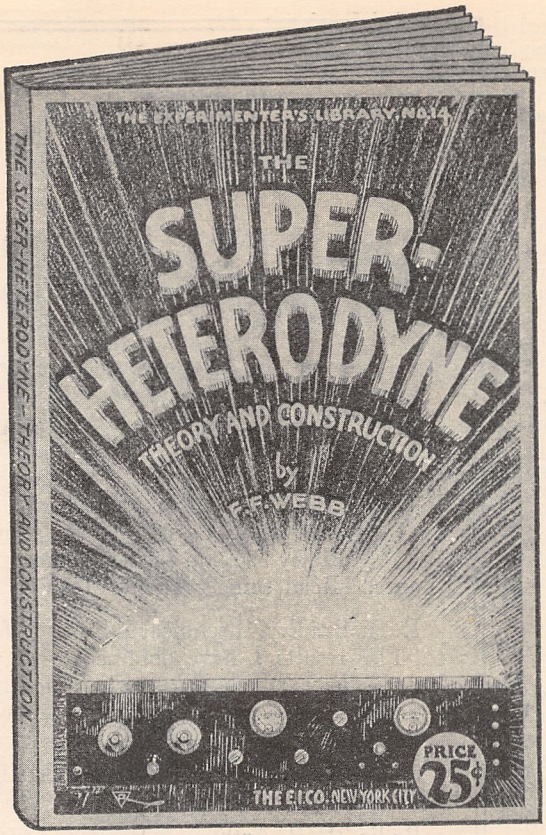


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It is believed that these statistics show that only the well financied stations and those maintained by radio manufacturers, which put on good programs, can exist for a long period and preserve their popularity.

## LOWER RANGES IN RECEIVERS NECESSARY

It is reported from several sources that most commercial broadcast receiving sets do not register very well on wave-lengths below 230 meters. This limit in the lower wave bands will have to be extended downward in new sets offered for sale, or Class A broadcasters assigned channels below 230 meters will have but limited audiences, although set owners would probably be able to pick up local stations. In the assignment of wave-lengths to Class A stations, the Department of Commerce has already been forced to allocate channels down as far as 209 meters. The lower limit recommended by the recent conference was 205 meters. Already 20 wave-lengths below 225 meters have been assigned, the lowest being 209 meters, given to station WTAC, at Johnstown, Pa. As this is a 100-watt station, it is doubtful if fans at any great distance are able to tune it in satisfactorily. By adjusting their sets, either by decreasing the inductance or increasing the series antenna capacity, however, it is believed lower tuning can be effected without difficulty.

## REPORTS LONG DISTANCE RECEPTION

The longest trans-oceanic reception during the recent International broadcasts, reported to the Department of Commerce, was about 5,000 miles. Dr. Willis Eugene Everett, owner of experimental station 6XCA, at San Rafael, just north of San Francisco, Calif., has written to Secretary Hoover that he heard station 2LO, London, on the second broadcast night for a period of eight minutes. He has sent his log to the Supervisor of the Sixth District.

## MEXICAN RADIO FANS GET DX

The native Mexican radio fans are more advanced in the general subject of radio and the construction of receiving sets than most people realize. These fans have established thousands of DX records, according to local radio experts, which is perhaps partly due to the fact that there are few large steel structures in Mexico to interfere with reception, but there is other interference in plenty. Electric street cars, defective transformers and some powerful spark stations cause interference just as in American cities.

If a fan doesn't bring in such stations as Oakland, San Francisco, Schenectady, New York, Springfield and Chicago every night, and occasionally a Canadian station, other receiving set owners don't consider that he has much of a set. Many fans started out with one, two or three tube sets, but now most of the real fans won't have anything but Neutrodynes or Super-heterodynes.

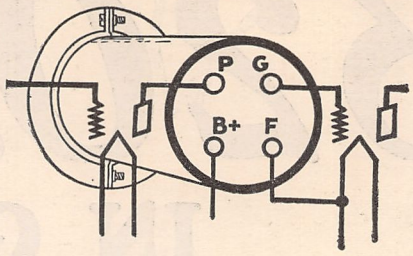
## BETTER AND SHORTER PROGRAMS DESIRED

By CARL H. BUTMAN

"Better and shorter broadcast programs" is likely to be the slogan of the radio public for 1925. Unless broadcast stations undertake to weed out amateurish and mediocre features and eliminate propaganda and publicity, their diminishing audiences may drop off to a minimum of a few hundred souls a station.

The average radio set owner hates to complain publicly, so the writer is disposed to take up the cause of the people, who after


RADIO FREQUENCY AMPLIFICATION WITH THE BALLANTINE VARIOTRANSFORMER

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Furthermore, the pure inductance tuning elements, surrounded by a metal case and connected through pigtails, reduce stray electrical noises to an indetectable minimum. Tones are comparable in quality to those produced by the best Victrola needle. The rest is up to the audio equipment. Start right with BALLANTINES.

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Complete radio frequency amplifier unit for use ahead of sets already built $15.00

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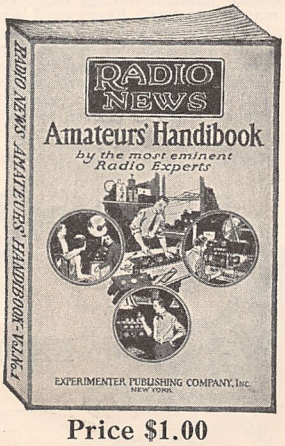


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EXPERIMENTER PUBLISHING CO., Inc.
53 Park Place, New York

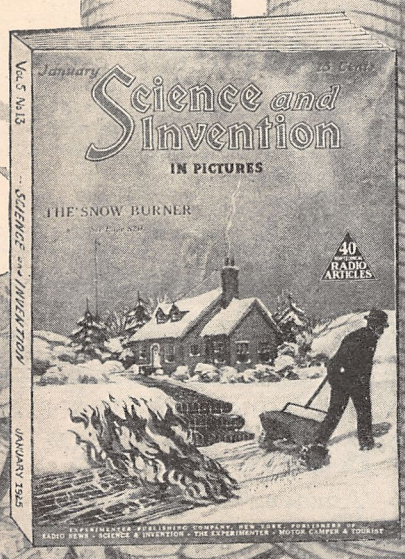
# $13,320.00 IN GOLD Was Paid by Science and Invention LAST YEAR

WITH the December, 1924 issue the SCIENCE AND INVENTION $12,000 a year prize contest came to a happy conclusion. Not only was there paid $12,000 in prizes as announced in the November, 1923 issue, but there was actually paid out in prizes alone, not less than $13,320.00 to 1,112 winners. These prizes every month ranged from the first prize of $100 down to the smallest prize winner of $1.00 each.

SCIENCE & INVENTION has no less than 18,590 reporters scattered over every section of the globe. These reporter-contributors have sent in an avalanche of material, and their efforts have been fruitful in that they have won prizes. SCIENCE & INVENTION aims to print the news first, if it is interesting and to otherwise excel in the reporting of science and invention. Small wonder then that with the enthusiastic co-operation of our thousands of Reporter-Correspondents, SCIENCE & INVENTION today occupies an enviable position in the scientific press.

The $12,000.00 prize arrangement has worked out so satisfactorily during the year just closed that we have decided to extend it for another year and we hope that our correspondents will be as successful in winning prizes for the coming year as they have been during the past one. We wish to thank all of our friends for their co-operation and wish them the best of luck for the coming year.

25¢ the Copy

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| 20 | " " | 10.00 | " |
| 10 | " " | 5.00 | " |
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| 10 | " " | 1.00 | " |

## WILL YOU BE OUR REPORTER?

IN connection with our $12,000 prize contest announced herewith, it goes without saying that you will have to do a little work in order to win a prize. The Editors do not wish to make it hard for you, quite the contrary. We want pictures and ideas and we cannot have too many of them.

Our reporters are winning prizes right along. We shall be glad to send the reporter's card free to anyone who makes an application for it. By means of this card you will be able to secure entry into industrial plants, business houses, motion picture studios, steamships, docks, public building, etc. This reporter's card will prove an open sesame to you in many instances. Every card is numbered and only one is given to a correspondent. A postal card from you and a request for this reporter's card is all that is necessary to obtain one. It will be sent to you by return mail. With it we will send you a pamphlet giving rules of the contest and how to proceed in order to get photographs, to send in sketches, and other information in order to obtain a valuable prize. Not only will this card help you to obtain material for this magazine, but it will train you to become a news gatherer, and will be the means of helping you to earn a good deal of money during your spare hours.

*Address* FIELD EDITOR, SCIENCE AND INVENTION, 53 Park Place, New York

**Science and Invention is sold on all Newsstands**

*Published by*

**The EXPERIMENTER PUBLISHING COMPANY, Inc.**

53 PARK PLACE

NEW YORK CITY

all are the real backers of the radio industry. An investment of almost a million dollars a day in radio apparatus entitles the people of radioland to a voice. The only reason for broadcasting is to create good will and a demand for receiving sets. Furthermore, radio broadcasting has been deemed a public utility.

As spokesman for the people, therefore, the writer files the following brief:

A year or two ago popular stations received hundreds of letters and telegrams of appreciation a day, but today some station managers admit they feel elated if they get 10 or 12 communications. Only new and exceptional features elicit anything like the hearty responses of the days of yore—scarcely a year ago. Either one of two things is happening: The "listener-in" is becoming terribly blasé or the programs are deteriorating. However, it is more probable that the real answer is, "Both." Nearly every fan, who has been listening in for a year, has overcome the first enthusiasm of holding anything he can pick up. While there are a few "DX Hounds" left, most of us prefer to get a special feature scheduled for a certain time or hunt until we find something exceptionally good. Several of my friends find it more difficult to select good entertaining programs. One of my counselors says he has to search further afield each time he listens in. Another says he often quits in disgust after trying 10 or 15 stations for some good music or features before he retires for the night.

This does not apply to all the 538 stations, but it does apply to the majority, and even to many of the Class B stations. A few of the old-timers seem able to retain their popularity. This is partly due to their long-established reputations or because they put on unique features and retain excellent performers. Good orchestras, quartets and stars who possess personality continue to hold the fans, and the dials are not shifted. But when a station tries to put on a continuous show for four or five hours every night, its particular circle of auditors begins to drop off. Some such stations in an effort to hold the air run in regular pluggers whose selections are not appropriate or have become a bore. Such programs smack of amateur theatricals or the old chaser acts put in variety programs to clear the house. We walk out on old and trite vaudeville acts and we tune out poor radio programs.

The vaudeville houses know that they cannot get enough stars or good acts to hold their audiences five or six hours, so they cut their programs to two and a half or three hours. Broadcasters might do well to pattern after the theatrical professionals who have been in the game a long time, and know what is what in entertainment programs. Theatrical producers would go bankrupt if they followed radio broadcast methods.

### SHORTER PROGRAMS OR INTERMISSIONS

The cutting of the evening programs to two or three hours on one or two nights a week would make additional friends for broadcast transmitters. It would enable hundreds and perhaps thousands of local fans to visit among the more distant stations, many of which are impossible to select when a powerful local is on the air. In some cities when the locals quit early, the delight of the listeners with less selective sets is supreme.

It is not believed that crystal set owners listen in continually every night and it is felt few often would complain if programs were curtailed.

If programs are not improved, fans ask why they cannot be curtailed or split with an intermission of about an hour at least twice a week. When three or four stations are forced to use the same wave-length, as is likely to be the case soon, due to the number of stations contemplated, this would aid in decreasing interference at least part of the time. In nearly every locality a "breathing spell" would be appreciated, since many listeners get "fed up" on local stuff.

Amsco quality radio parts—the standard of excellence, by which all other parts are judged. Used by many leading set manufacturers as well as by the foremost radio engineers for laboratory work.

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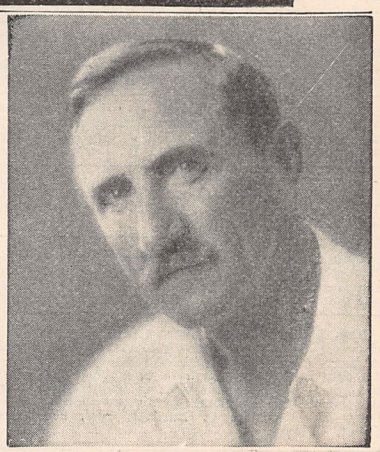

PAUL von BOECKMANN
*Author of "Nerve Force" and various other books on Health, Psychology, Breathing, Hygiene and kindred subjects, many of which have been translated into foreign languages.*

The high pressure, mile-a-minute life of today, with its mental strain, worry, anxiety, grief and trouble, not to mention nerve strains resulting from excesses and vices, is **wrecking the nerves** of mankind. This applies especially to the people with highly active brains and sensitive nerves. Have your Nerves stood the strain?

Read **"Nerve Force,"** a 64 page book on the care of the nerves. This book is of extreme value to "near-neurasthenics" and people with sensitive and deranged nerves. It has aided many thousands to gain control of their nerves and build up their Nerve Force. Because of the many valuable hints it contains on the control of the nerves and mind, "Nerve Force" has been bought by the thousand by large corporations for their employees; it is recommended by physicians to their patients and by ministers to their flocks.

**NERVES OR NO NERVES, YOU SHOULD SEND FOR THIS BOOK TODAY**
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**What Readers of "Nerve Force" Say:**

"I have gained 12 pounds since reading your book, and I feel so energetic. I had about given up hope of ever finding the cause of my low weight."

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"Reading your book has stopped that dreadful feeling of FEAR which paralyzed my stomach and digestion."

"Your book did more for me for indigestion than two courses in dieting."

"My heart is now regular again and my nerves are fine. I thought I had heart trouble, but it was simply a case of abused nerves. I have reread your book at least ten times."

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**Write to PAUL von BOECKMANN, Studio 320, 110 West 40th Street, New York City**

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Classified advertising rate twenty-two cents a word for each insertion. Ten per cent discount for 6 issues, 20 per cent discount for 12 issues. Name and address must be included at the above rate. Cash should accompany all classified advertisements unless placed by an accredited advertising agency. No advertisement for less than 10 words accepted.

Objectionable or misleading advertisements not accepted. Advertisements for the April issue must not reach us later than Feb. 1st.

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**Agents Wanted** in every city and town to sell standard radio apparatus. Attractive discounts given. If interested write us at once stating age and radio experience. Wilmington Electrical Specialty Co., Inc., 405 Delaware Ave., Wilmington, Delaware.

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**Radio Salesmen wanted**—Make $50.00 weekly selling standard, well advertised radio sets and parts. No investment necessary. Write for plans and Free Outfit. Waveland Radio Corporation 1027 N. State St., Chicago, Ill.

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**No dull times in the Food business.** Selling Federal Pure Food Products is the greatest, surest and safest business in the world today and here is your opportunity to get into it. You can make $3,000, $5,000, $10,000 or more per year—the only limit is your ability to take care of the business. You will need no experience or money to get into this business as we send you our handsome $15.00 Sample Case on Trust and teach you everything you need to know. No Dull Times for the People must eat and our food products are the fastest selling, surest and quickest repeat order goods in the world. Sell on sight in every home where food is used—repeat orders immediatly and every week thereafter. A real big business all your own. Every new customer adds a great deal to your weekly income. Your business, once established, has a market value just like a store and can be easily sold. The greatest money making opportunity of your lifetime because you risk absolutely nothing as we Guarantee your sales, and we will not let you fail. Remember! Guaranteed! Best products, biggest sellers, surest repeat orders. No capital or experience is required. We furnish capital and everything necessary for you to Become a Federal Distributor. Exclusive territory will be given honest men or women who write at once. Federal Pure Food Company, 2309 Archer Avenue, Dept. J, Chicago, Ill. Largest packers of Pure Food specialties in the world. Reference, any bank, Dun or Bradstreet rating agency, Express or Railway Company in America.

**$100 weekly.**—Pleasant work; appointing local agents to introduce Mother Hubbard Foods; no canvassing; no delivering; no money invested. Adam Inthout, 556 Congress, Chicago.

## *Agents Wanted (Continued)*

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**Big Money Selling New Household Cleaning Set.** Washes and dries windows. Sweeps, scrubs, mops. All complete only $2.95. Over half profit. Write Harper Brush Works, 160 3rd Street, Fairfield, Iowa.

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**French Radio Accessories** manufacturer seeks American representative, having experience, facilities, and capital to finance purchases. Excellent goods, low prices. Radio International, 40 Rue Laffitte, Paris, France.

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**Super Heterodyne,** manufactured by Experimenters' Information Company. The Rolls Royce set. There is no better set than this on the market. Fully assembled and wired by the Company in expensive mahogany cabinet, bakelite panel, ready to operate. Due to death of owner outfit must be sold. Set takes 8 tubes. Size of outfit is 40" by 39" by 10". Set originally cost owner $200. No reasonable offer refused. Box No. 200 Radio News.

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**Men to build radio** sets in spare time. Leon Lambert, 595-H Kaufman Bldg., Wichita, Kansas.

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## *Insects Wanted*

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**Learn Chemistry at Home.** Dr. T. O'Conor Sloane, noted educator and scientific authority, will teach you. Our home study correspondence course fits you to take a position as chemist. See our full page ad on page 1527 of this issue. Chemical Institute of New York, 66 W. Broadway, New York City.

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**Esperanto beginners.** Send ten cents for booklet, or 50 cents for grammar, reader and vocabulary for self-instruction. Esperanto Association of North America, Pierce Building, Boston, Mass.

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**Beautiful registered bull pups cheap. Bulldogs. 501** Rockwood, Dallas, Texas.

**Arthel Shorthand learned in four evenings.** Full course seven dollars. Used everywhere. Sent on approval. Particulars, Hollefreund's College, Stratford, Ontario, Canada.

**Get posted.** Good prices paid for butterflies, insects. See Sinclair display advertisement, page 1572.

### *Motorcycles. Bicycles*

**Don't Buy a Bicycle Motor Attachment** until you get our catalog and prices. Shaw Mfg. Co., Dept. 6, Galesburg, Kansas.

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**Earn $25 weekly,** spare time, writing for newspapers, magazines. Experience unnecessary. Copyright book free. Press Syndicate, 973, St. Louis, Mo.

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**Inventors**—Should write for our Free Guide Books and "Record of Invention Blank" before disclosing inventions. Send model or sketch of your invention for our Free Examination and Instructions. Radio, Electrical, Chemical, Mechanical and Trademark experts. Terms reasonable. Victor J. Evans & Co., 922 Ninth, Washington, D. C.

**Patents**—Send for form 'Evidence of Conception" to be signed and witnessed. Form, fee schedule, information free. Lancaster and Allwine, Registered Patent Attorneys in United States and Canada, 269 Ouray Bldg., Washington, D. C.

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### *Patents*

**Inventions Commercialized.** Patented or unpatented. Write Adam Fisher Mfg. Co., 278, St. Louis, Mo.

**Unpatented Ideas Can Be Sold.** I tell you how and help you make the sale. Free particulars (Copyrighted). Write W. T. Greene, 804 Jenifer Building, Washington, D. C.

### *Personal*

**Lonesome**—Join our club—make acquaintances everywhere. Big illustrated book with descriptions and photos, sent in plain wrapper for ten cents. Bonafide Co., Dept. 58, Kansas City, Mo.

**Exchange cheery letters** with new friends. Write Betty Lee, Inc., Box 820 City Hall Station, New York City. Stamp appreciated.

**Free to Men or Women**—Information of a scientific nature that has brought physical vigor and happiness to thousands. No charge; no obligation. Write Fair Sales Co., Dept. 246A, Colorado Springs, Colo.

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**Lonely**—Join Our Club. Make friends everywhere. Particulars free. Write Mrs. Mathews, Box 26, Oakland, Calif.

### *Position Wanted*

**Export man,** intimate knowledge radio, foreign markets, languages. Sichel, 6 Cliff St., N. Y.

### *Radio*

**Make Your Next Reach Out**—Same panel, same layout, fewer parts. Our $5.00 Kit includes the one different part, 22 feet real gold sheathed wire, lithographed print of Kladag Coast to Coast Circuit, and complete, simple instructions. Nothing else to buy. Gives selectivity with deep, resonant volume. Not obtainable elsewhere. We originated this and can name scores of buyers it has delighted. Satisfaction Guaranteed. Details—10c. Kit prepaid anywhere, $5.00. New 48-page catalog, thousands of items, many exclusive for stamp. We accept postage stamps same as cash. Kladag Radio Laboratories, Kent, Ohio.

**Boys! Don't Overlook This. The "Rasco"** Baby Detector. Greatest detector ever brought out with molded base. Fully adjustable. See former advertisements in this publication, or our catalog. Detector with Galena Crystal, complete 50c, the same detector with Radiocite Crystal, 75c prepaid. Send for yours today. Radio Specialty Company, 96-98 Park Place, New York City.

**Attention!**—50 Vacuum tube hook-ups. The greatest collection of vacuum tube circuits ever brought under two covers at such insignificant cost. These diagrams will be found in the great "Rasco" catalog, which contains raw materials and parts in a greater profusion than any other catalog. 15c in stamps, or coin, will bring the catalog to you. Radio Specialty Co., 96-98 Park Place, New York City.

**Ivory Radio Panel:** Grained white "Ivorylite" makes most beautiful set of all. Guaranteed satisfactory. Any size 3-16" thick sent prepaid 3c per square inch. Sample free. E. P. Haltom, Dept. N, 614 Main St., Fort Worth, Texas.

**Send me your burned out or broken Power tubes**—50 watts or over. Will pay liberally. W. Baker, 36 W. 20th St., New York City.

**Have your broken and burned out Power tubes repaired,** 50 watts or over. Send them to us for Repair. Charges reasonable. Wm. Baker, 36 W. 20th St., New York City.

**Inquiries solicited** for manufacturing Radio Cabinets. We have dry kiln and complete machinery including spraying facilities. Reliable responses only considered. XYZ.

**Australian firm** is interested in obtaining the sole agency from American manufacturers of wireless parts of every description, including valves, loud speakers, crystal detectors, transformers, condensers etc. Address S. Segal & Co., Ltd., P. O. Box 2956, G. P. O., Sydney.

### *Radio (Continued)*

**2650 Miles Distance with one tube.** Any Novice understands our simplified instructions. Big free booklet tells the story. Vesco Radio Co., Box RC-117, Oakland, Calif.

**Log-Book**—Space 300 Stations, 25c postpaid. Roy Stacy, Rockford, Ill.

**Inexpensive five foot utility coiled horn** with twelve inch bell, correct proportions, Baldwin phone, four foot cord, goes on small table top, excellent tone so you may enjoy programs by the hour with great pleasure. Price $6.50. Box 764, Northampton, Mass.

**Save Money** by building your own "B" Storage Battery. Batteries may be built at home for voltages from twenty to two hundred volts. Sample cell with complete instructions $.25. Co-operative Merchandise Company, Box 127, Chelsea, Mass.

**How to Pass Examination** for Amateur License, Questions and Answers. $1.00. Reliable A. E. Cooper, 5232 Beaumont Ave., Phila., Penna.

**Tested Galena Crystals,** 50c pound; untested, 25c. Box 1005, Joplin, Mo.

**Music Master Speaker $24;** Radiola Regenoflex $120; Crosley Tridyn $52. Send for our price list of all nationally advertised and guaranteed receiving sets and accessories. Service Sales Corporation, Shelby, Ohio.

**Roberts Circuit**—Last word in radio hookups, combining neutrodyne principle with reflexing and regeneration. Push pull amplification for unequalled volume and clearness added to tuned radio frequency, regeneration and reflexed audio make a long distance getter of surprising clarity and volume. Tuning so sharp that local station interference is unknown to the owner of a Roberts. Genuine Roberts coils with instructions for assembling—$8.00. Complete kits of quality parts for 4 tube set—$49.75. Let us send you particulars. Wesco Radio, 2162 North California Avenue, Chicago, Ill.

**Tetradyne**—Transcontinental all standard parts, simple to build, three tube, powerful receiver. Your opportunity to enter the Radio business or build your own set. For full particulars address, Tetradyne, 385 45th St., Milwaukee, Wis.

**An old and well established** manufacturing company in the middle west with large, well equipped plants and unusual financial resources, desiring to enter the radio field, will consider the manufacture and sale of Radio sets or devices of outstanding and unusual merit on a royalty basis. Address Box 210, Radio News.

### *Salesmen Wanted*

**A Salesman** wanted in every town or city within 25 miles of a broadcasting station to sell Radiogem, the complete radio receiving set that retails for $2.50. With Radiogem there is nothing else to buy—the outfit includes the Radiogem receiving apparatus, 1,000 ohm phone, and aerial outfit. The cheapest radio outfit on the market—yet as practical as the most expensive. Big money to the right men. Send $2.00 for sample outfit. The Radiogem Corp., 66-R West Broadway, New York City.

**Were You Ever Offered a Grocery Store?** Our proposition is better. You can handle flour, canned goods, dried fruit, coffee and entire line of groceries as well as radio sets, paints, roofing and automobile oils and tires with no rent to pay; no money invested; take large orders from samples. Goods are guaranteed and proven quality. Selling experience not necessary. Steady, profitable work for "workers." Address Hitchcock-Hill Co., Dept. 204 Chicago, Ill. Reference: Any bank or Express Company.

**Beats a Gold Mine**—Electric Sign, sells $15.00. Commission $5.00. Easy to sell 100 to 1000 at once to Manufacturers of Autos, Ice Cream, etc., for distribution to their Dealers or Agencies, or, several an Hour from Store to Store. Write while its new. Flashtric, 2128 Hudson, Chicago.

**Salesmen**—Sell Four Square Suits $12.50—guaranteed two years. All wool overcoats $19.50, five different patterns. $3.00 to $5.50 each sale. Profits in advance. Complete line, coat, vest, pants, riding pants, overcoats, slip-ons, caps. One day delivery. District territories open. Stone-Field Corporation, W. 2556 South Wabash, Chicago.

### *Scenery to Rent*

**Settings for Opera,** Plays, Minstrels. Plush Drops. Address Amelia Grain, Philadelphia.

### *Stamps and Coins*

**158 Genuine Foreign Stamps.** Mexico War Issues. Venezuela, Salvador and India Service. Guatemala, China, etc., only 5c. Finest approval sheets 50 to 60%. Agents wanted. Big 72-p. Lists Free. We buy stamps Estab. 20 years. Hussman Stamp Co., Dept. 146, St. Louis, Mo.

**You'll get profit and pleasure** collecting old coins. Send 10c for genuine old coin and large coin catalog. This is just a get-acquainted offer. Send today. You'll be delighted with it. B. Max Mehl, Numismatist, Dept. R, Mehl Building, Fort Worth, Texas. Largest Coin Firm in U. S.

### *Telegraphy*

**Telegraphy—Both Morse and Wireless** taught thoroughly. Big salaries. Wonderful opportunities. Expenses low: chance to earn part. School established fifty years. Catalog free. Dodge's Institute, Cour St., Valparaiso, Ind.

### *Wanted to Buy*

**Full Value Paid** for Old Gold, Jewelry, Watches, Diamonds, crowns, bridges, dental gold, silver, platinum, gold or silver ore; magneto points, old false teeth. Packages returned if our offer is not satisfactory. United States Smelting Works (The Old Reliable) 120 So. State St., Dept. 16, Chicago, Ill.

### *Wanted*

**Radio Salesman** of proven ability by Manufacturer to handle a line of quality parts. Box 205 Radio News.


# How Radio Is Received

BOOK NO. II

By R. S. Ould of the Bureau of Standards of the U. S. Government.

This new book of the E. I. Co. tells thoroughly and completely just how radio is received. How the radio waves originate, are sent out into space and finally received on the antenna and telephones. It enables you to understand the principles of the reception of the voices and music you receive daily out of the air.

This is one of the handiest of the E. I. Co. books for the amateur radio listener. It explains in a very clear way how Radio is transmitted and received. It contains 64 pages, size is 5 x 8 inches and is bound with a stiff cardboard cover and printed in two colors.

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PRICE 25c

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233 Fulton St., New York, N. Y.

# How we made our radio

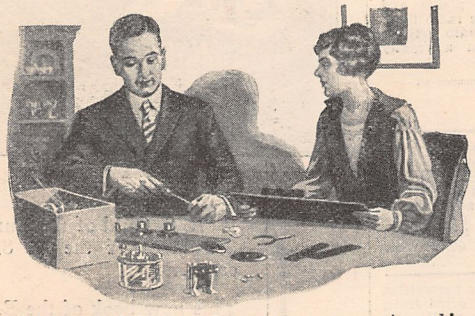
## —the best evening we've spent in months!

THE other night I brought an Acmeflex Kitset home under my arm. "What have you got there?" asked my wife. "It's not what I've got here *now,*" I said, "but it's what this will be made into *three hours from now,* dear, that interests me. This is the makings of the famous Acme Reflex. It's called the Acmeflex Kitset. Three hours from now we'll be listening to

*"I brought it home under my arm"*

### *A set as good as there is*

AS SOON as dinner was over, we opened the box, and found, just as I'd been told, all the parts for the complete set. And even a screwdriver and pair of pliers to put it together with! Can you beat that! Those are the only two tools we had to use, as there is no soldering to do, and the panel is all drilled.



*"We certainly saved some money getting this set; and look at the fun we're having!"*

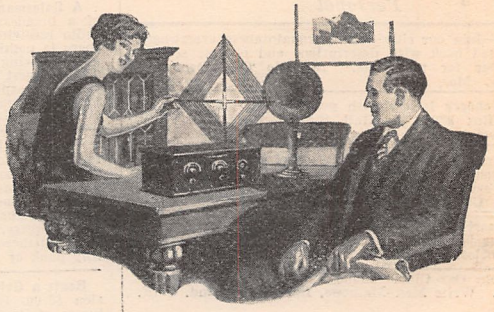
INCLUDED in the kit also was a book of instructions and two large sheets, one giving the wiring diagram for the set both from the baseboard view and the panel view; the other a life-size drawing, showing exactly how every wire entering the set was to be bent. Screws, nuts and bolts were in a box by themselves, with a few extra ones in case one or two roll under the sideboard or something!

### *Anyone can make an Acmeflex*

WE SPREAD out the parts on the dining-room table, and then started on the best fun we've had for months. The time just flew. And the way our set went together convinced me that the greenest of novices can now sit down and build a radio set that will perform on a plane with the highest priced factory made receivers. In just short of three hours we were listening to a violin concert, and that included the assembly of the loop, parts for which are included in the kit. The only accessories we had to get were the tubes, batteries, loud speaker and cabinet.

### *More, tube for tube, than any other set, made or bought*

THE finished Acmeflex Kitset, a Reflex set, gives three stages of radio frequency amplification, three stages of audio frequency amplification, and a crystal detector, with only four tubes. It brings distant stations right into the house clearly with a minimum of tuning, and has wonderful amplification without distortion.



*"That's one on the boss. Here we get distant stations loud and clear that he can't get at all, and he paid twice as much for his set!"*

### *Send 10 cents for book "Amplification without Distortion"*

SEND 10 cents for 36-page book, "Amplification without Distortion," containing many hints for getting the best out of your set. Special circular on the Acmeflex Kitset will be sent free with the book. Send the coupon today.

ACME APPARATUS COMPANY
*Transformer and Radio Engineers and Manufacturers*
Dept. 73, Cambridge, Mass.

# ACME
## ~ for amplification

ACME APPARATUS COMPANY,
Dept. 73, Cambridge, Mass.

Gentlemen:—Enclosed find 10 cents for copy of "Amplification without Distortion." Please also send me free special circular on the Acmeflex Kitset.

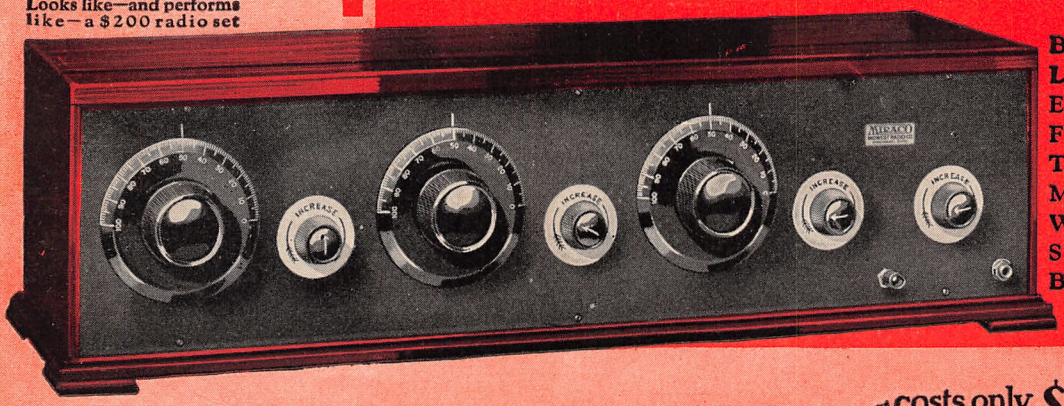
*Name* .....

*Street* .....

*City* ..... *State* .....

# Combines distance, selectivity, power, deep full tone, beauty and simplicity!

Looks like—and performs like—a $200 radio set



BUILT TO GIVE LOUD SPEAKER ENTERTAINMENT FROM STATIONS THOUSANDS OF MILES DISTANT WHILE LOCAL STATIONS ARE BROADCASTING

## "Coast to Coast" reception verified by Miraco Users

**NOTE!** Do not judge Miraco sets by their prices. Enormous production makes them cost less. They are built—by pioneer set makers—of highest grade parts. They embody improvements, refinement and features used in the most costly sets. Every Miracouser is an enthusiastic booster—these letters are typical of the many we receive.

### Oklahoma Hears Europe

Nov. 27th, was able to get two of the foreign stations on my Miraco, also Porto Rico and Guatemala, Mexico.—W. J. Lowe, Verdun, Okla.

### Michigan Hears Germany

My Miraco is working fine. Nov. 28th I got 5NO, Newcastle, England and LP, Berlin, Germany. Can you beat that record?—Thomas Walker, Howell, Mich.

### Pennsylvania Hears Paris

Believe Miraco the best distance-getter on the market for the price. Nov. 24th I picked up Paris, also Havana, Cuba and San Juan, Porto Rico. Nov. 25th I picked up 5NO Newcastle, England. Nov. 27th got 5NO and 2BD Aberdeen, Scotland. Now have 98 other stations on my log to date including KGO, Oakland, Calif.—Earl C. Way, Coleman, Pa.

### Indiana Hears Europe Nightly

During the European test I had some foreign station every night on my Miraco. Nov. 22nd I also heard New York, Los Angeles, Canada, Texas and 31 others.—C. J. D. Rudolph, Evansville, Ind.

### Kansas Hears Coast to Coast

Am using a Miraco and will let the following list of stations tell what I think of your sets. These are not all the stations I have tuned in as I do not "log" a station unless I hear it at least twice. The unrecorded stations include several in Canada, two in Mexico and one in Cuba. Expect to do better still: KHJ, KFI, Los Angeles; KGO, Oakland, Cal.; KPO, KVO, San Francisco; WBZ, Springfield, Mass.; WGY, Schenectady, N. Y.; WOO, Philadelphia; WSB, Atlanta, Ga.; KEDX, Shreveport, La., WOAI and WCAR, San Antonio, Tex.; WFAA and KFOP, Dallas, Tex., WBAP, Ft. Worth, Texas; WWJ, Detroit, WMC, Memphis, Tenn.; WSAI and WLW, Cincinnati; WBT, Charlotte, N. C; WGR, Buffalo; WRAH, Minneapolis; WCAM: Villanova, Pa.; KSD, St. Louis, WOAW, Omaha; KOKA, Pittsburgh; WEBH, KYW, WGN and WMAQ, Chicago; WTAS, Elgin, Ill., and twenty others in Missouri, Kansas, Iowa, Illinois, Minnesota, Nebraska and Oklahoma.—J. A. West, Augusta, Kansas.

### Michigan Hears 180 Stations

Am sending list of stations I received on my Miraco in 3 weeks: KDKA, KDPM, KFCH, KECV, KFDA, KFDP, KFDU, KFHF, KFI (Los Angeles), KOP, KOL, KRE, WAAD, WAAF, WABJ, WBAD, WBBA, WBZ, (Springfield, Mass.), WCAE, WCAL, WCAM, WCAP, WCAS, WCBD, WCE, WCK, WCN, WCX, WDAE, WDAF, WDAJ, WDAK, WGN, WDT, WIBZ, WEAF, WEAI, WEAN, WEAO, WFAA, (Dallas, Tex.), WFAF, WFAV, WFI, WGAN, WGAY, WGAZ, WGL, WGM, WGR, WHA, WGY, WHAI, WHAR, WHAZ, WHK, WIP, WJAJ, WJAN, WJAR, WJAS, WEBH, WLAV, WLW, WMAJ, WNAC, WNAQ, WOAH, WOC, WOO., (Philadelphia), WOS, WDAP, WPAZ, WPG, WPI, WQAJ, WSAI, WSY, WTAG, WTAS, WTG, WWJ, WTAK, WLAC, WHN, (New York City), WDL. This is all the list I have on hand. At the house I have 180 in all.—Howard L. Goodsill, Clinton, Mich.

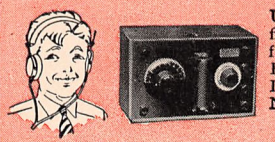
## The Marvelous MIRACO Ultra 5 — costs only $75

[FIVE TUBE OUTFIT IN BEAUTIFUL SOLID MAHOGANY CASE]

Send coupon for SPECIAL OFFER!

**Completely built, thoroughly tested and factory guaranteed by one of America's oldest and most reliable manufacturers of quality sets!** Years of experience and quantity production explain its almost incredible price. Users, who have deluged us with commendations, say that friends **who see and hear** it are amazed that it sells for less than $150 or $200. Radio experts, who **know** good construction and quality parts, are equally astonished. You, too, will be delighted, thrilled, amazed with your big five-tube Miraco "Ultra 5" in its beautiful hand-rubbed solid **mahogany** cabinet! You'll be envied by radio friends who paid big prices for their outfits.
Imagine getting all this for $75—a beautiful sweet toned "coast to coast loud speaker" set, composed of finest parts, housed in solid mahogany, equipped with the latest improvements, refinements and features found on costliest sets—and factory guaranteed! An instrument approved by radio's highest authorities! A set anyone can connect and operate. Even beginners learn quickly to cut through the "locals," get distant stations loud and clear, log stations and return to them at will. (Full directions with each set.) It is non-radiating, non-distorting, non-howling. Has cut-out switch—and a first stage phone jack for tuning—on Bakelite panel. All wiring concealed under Bakelite sub-base. Works on storage battery or dry cells. Literature describes other newest features.

## Other Miraco Long Distance Sets $14.35 up



Users tell us that Miraco Model R justly deserves its title, "Radio's finest low priced quality receiver." One tube acts as a tuned radio frequency amplifier and detector combined. A great distance getter. Easy to operate and log. Covers all wave lengths 150 to 625 meters. Like all Miraco sets, it operates on a storage battery or dry cells. Never such value before at only **$14.35**

MIRACO RADIO GETS 'EM COAST TO COAST

This wonderful new Miraco Model R-3 is the three-tube, long distance, loud speaker set that has created such a sensation. Easy to tune and log. Covers wave lengths 150 to 625 meters. Detector acts also as a tuned radio frequency amplifier. 2 stages audio frequency amplification. Has no equal for simplicity, volume, range or clearness at anywhere near its price **Miraco R-3 only $29.50**

These Miraco sets are as easy as a phonograph to operate. Built throughout of highest grade parts. Full directions for connecting and operating supplied with each set. No experience necessary. The three and four tube sets have cut-out switch and first stage phone jack. Each set completely built, thoroughly tested and factory guaranteed.

The famous Miraco Model MW four tube "coast to coast loud speaker" outfit which users all over the country report outperforms and outdistances much costlier sets. Comes in a solid mahogany cabinet. The improved 1925 model is equipped with cut-out switch, first stage phone jack for tuning (removing plug automatically switches program to loud speaker) and other latest features. Employs one stage of radio frequency amplification, detector and two stages of audio frequency amplification. Another unmatched Miraco value, $54.50.

## All the Proof you want is waiting for You!

Reports from the many users in every state prove Miraco Tuned Radio Frequency Receivers—at rock bottom prices—have efficiency of sets costing up to three times as much. Remember that Miraco Sets are the product of a long established, reputable manufacturer—pioneer builders of sets. Send for further evidence that they are Radio's finest moderately priced receivers. All Miraco sets bear the endorsement of radio's highest authorities. Mail coupon now for latest bulletins and plenty of additional testimony from users leaving no doubt that "Miraco Radio Gets 'em Coast to Coast."

**DEALERS! JOBBERS!**
Write for the new Miraco proposition. Nation-wide use and popularity of Miraco Sets, their amazingly low prices and our extensive advertising, makes them wanted everywhere. Send coupon.

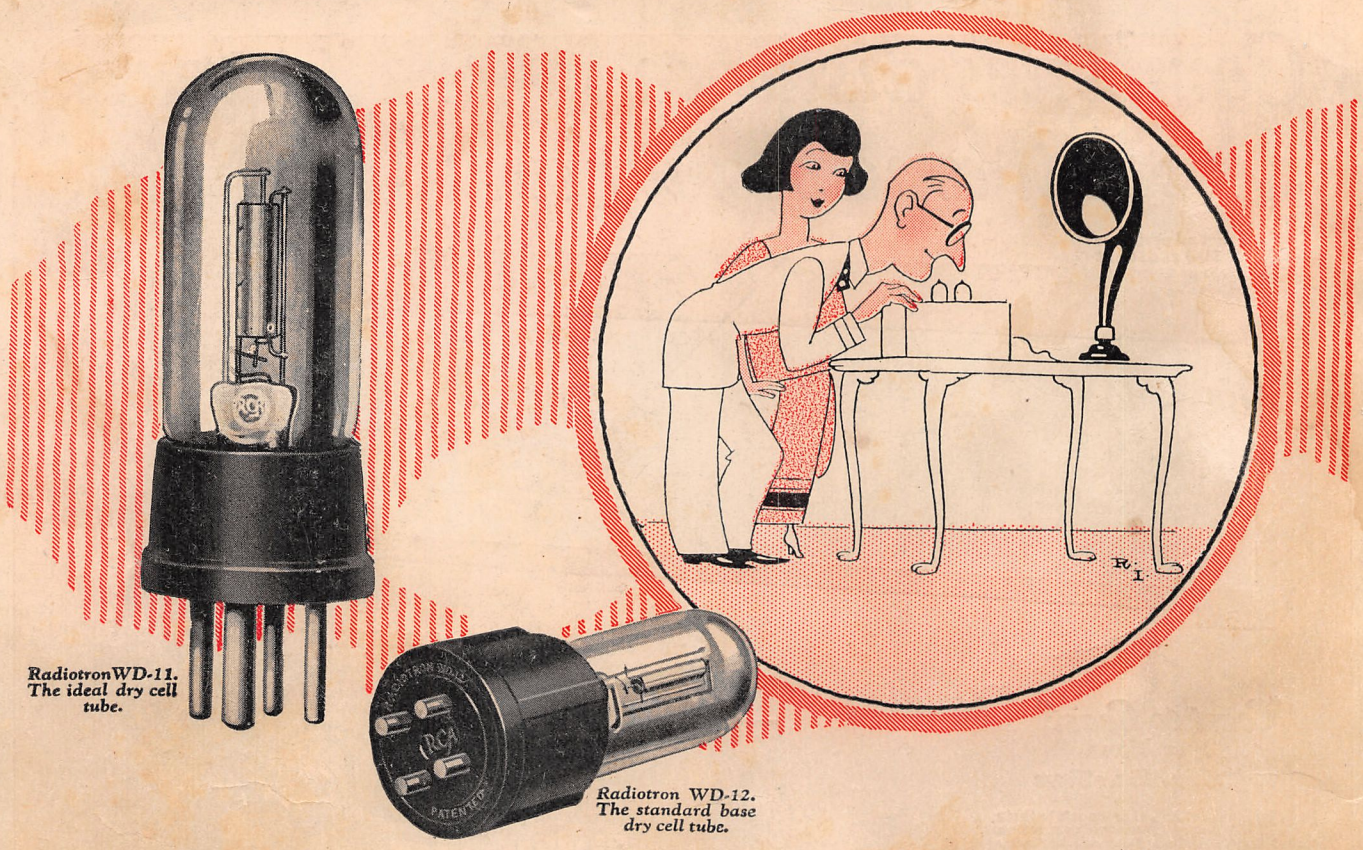
**AGENTS!**
The wonderful tone, volume and distance-getting ability of Miraco Sets makes them easy to sell. Send coupon for proposition; good territory open.

*Send coupon for free bulletins* [or order direct from this ad]

MIDWEST RADIO CORPORATION
*Pioneer Builders of Sets*
Cincinnati, Ohio
404-T East Eighth Street
Send free literature, your SPECIAL OFFER and all particulars regarding Miraco Sets. ( ) Jobber. ( ) Dealer. ( ) Agent. ( ) User.

*Name* .....

*Address* .....



Radiotron WD-11. The ideal dry cell tube.

Radiotron WD-12. The standard base dry cell tube.

# Get a good detector

What will Radiotron WD-11 and WD-12 do as detectors? First—they are sensitive to weak signals—superlatively sensitive, as remarkable distance performances show in thousands of one-tube sets. Second, they are good "oscillators"—and that is important in regenerative circuits. And third, they are quiet in operation—add no electrical noises to the music, or speech. Radiotrons WD-11 and WD-12 are famous as audio and radio frequency amplifiers—too—and have made possible the hundreds of thousands of dry battery receivers that are in use today. They mean clear, true reception—over big distances—with dry batteries. Be sure to get a *genuine Radiotron*.

Radiotrons WD-11 and WD-12 are the same tube but with different bases.

Radiotron WD-12 has a standard navy type base. With it, you can change your set to dry battery operation. Ask your dealer today.

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